

Plaintiffs' Exhibit 8

(Redacted)

**IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF VIRGINIA**

Alexandria Division

UNITED STATES, et al.,)	
)	
Plaintiffs,)	
v.)	No. 1:23-cv-00108-LMB-JFA
)	
GOOGLE LLC,)	
)	
Defendant.)	

**DECLARATION OF ROBIN S. LEE
IN SUPPORT OF PLAINTIFFS' OPPOSITION TO
GOOGLE'S MOTION FOR SUMMARY JUDGMENT**

Robin S. Lee, PhD., being duly cautioned, declares as follows:

1. I am over 21 years old and am competent to testify about the matters in this Declaration based on my personal knowledge.
2. Attached hereto as Exhibit A is a true and correct copy of the December 22, 2023, Expert Report of Robin S. Lee, PhD. Attached hereto as Exhibit B is a true and correct copy of the February 13, 2024, Expert Rebuttal Report of Robin S. Lee, PhD, along with associated errata. Attached hereto as Exhibit C is a true and correct copy of the March 4, 2024, Expert Supplemental Report of Robin S. Lee, PhD.
3. I authored the attached Expert Reports identified in Item (2) above and understood at the time I signed them that they were being prepared for use in this litigation. I am prepared to testify at trial, under oath, to the matters set forth in these reports. My statements set forth in these reports, as modified by associated errata, are true and correct to the best of my knowledge.
4. The exhibits attached to the reports described in Item (2) are true and correct copies.

I declare under penalty of perjury that the foregoing statements in this Declaration are true and correct.

Dated: *May 10, 2024*

Signed: 

Robin S. Lee, PhD.

County and State: *SUFFOLK COUNTY, MA*

**IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF VIRGINIA
Alexandria Division**

United States of America, *et al.*,

Plaintiffs,

v.

Google LLC,

Defendant.

Case No. 1:23-cv-00108-LMB-JFA

Hon. Leonie H. M. Brinkema

EXPERT REPORT OF ROBIN S. LEE, PHD

December 22, 2023

Expert Report of Robin S. Lee, PhD

I. Introduction	1
I.A. Qualifications	1
I.B. Scope of charge	1
I.C. Materials relied upon	2
I.D. Summary of opinions	3
I.E. Summary of report	4
I.E.1. Google's market power in the relevant markets	5
I.E.2. The competitive effects of Google's conduct	8
II. Industry background	13
II.A. Digital display advertising	13
II.A.1. Ad tech products for display advertising and their customers	26
II.A.2. Uses of different forms of digital advertising	27
II.A.3. Audience targeting	28
II.A.4. Types of display advertising transactions	29
II.B. Ad tech products used for web display advertising	38
II.B.1. Publisher ad servers	41
II.B.2. Advertiser bidding tools	43
II.B.3. Ad exchanges	47
II.C. Google's ad tech products	49
II.C.1. DoubleClick for Publishers (DFP)	49
II.C.2. AdX	54
II.C.3. Google Display Network (GDN)	55
II.C.4. Display & Video 360 (DV360)	58
II.C.5. Other Google ad tech products	59
II.D. Fees for ad tech products	61
II.E. Historical evolution of the sale of indirect display advertising	64
II.E.1. The waterfall	64
II.E.2. Dynamic Allocation and Enhanced Dynamic Allocation	66
II.E.3. Header bidding	68
II.E.4. Open Bidding	70
II.E.5. Unified first price auction (UFPA)	71
III. Economic concepts for analyzing competition among ad tech products for open-web display advertising	73
III.A. Indirect network effects	73
III.B. Pricing and market power	75
III.C. Tools that facilitate multihoming and reduce switching costs tend to enhance competition and reduce market power	78
III.D. The importance of scale for the competitiveness of ad tech products	82
III.D.1. Greater advertiser and publisher usage generates positive indirect network effects	84
III.D.2. Greater usage improves scale economies for an ad tech product	87
III.D.3. Scale generates data that improves the attractiveness and profitability of ad tech products and facilitates experimentation	88
III.E. Economics of auctions	94
IV. Market definition	99
IV.A. Market definition for monopolization claims in the ad tech stack	100
IV.A.1. The hypothetical monopolist test for monopolization claims	101
IV.A.2. Relevant markets typically exclude some substitutes, and may exclude alternatives that are used alongside products within the relevant markets	104
IV.B. Open-web display advertising is a distinct and important form of advertising for publishers and advertisers	107

IV.B.1. Open-web display advertising is an important and distinct form of monetization for publishers	108
IV.B.2. Open-web display advertising is an important component of marketing for advertisers, and distinct from other forms of advertising.....	113
IV.B.3. Industry participants recognize the distinctiveness of open-web display advertising	123
IV.B.4. Indirect transactions for open-web display advertising provide additional distinct value to publishers and advertisers.....	125
IV.C. Publisher ad servers is a relevant product market	129
IV.C.1. Open-web publishers lack effective substitutes for publisher ad servers	132
IV.C.2. Industry participants recognize that publisher ad servers are a distinct product	136
IV.C.3. A hypothetical monopolist of publisher ad servers would likely charge quality-adjusted prices above competitive levels	137
IV.D. Ad exchanges is a relevant product market	137
IV.D.1. Open-web publishers and advertisers lack close substitutes for ad exchanges	138
IV.D.2. Industry participants recognize that ad exchanges are a distinct product.....	141
IV.D.3. A hypothetical monopolist of ad exchanges would likely charge quality-adjusted prices above a competitive level	142
IV.E. Advertiser ad networks is a relevant product market.....	143
IV.E.1. Advertisers and open-web publishers lack close substitutes for and derive significant value from advertiser ad networks	146
IV.E.2. Industry participants recognize that ad networks are distinct products	155
IV.E.3. A hypothetical monopolist of advertiser ad networks would likely charge quality-adjusted prices above competitive levels	157
IV.F. Relevant geographic markets for publisher ad servers, ad exchanges, and advertiser ad networks ..	158
IV.F.1. A relevant geographic market for all product markets is worldwide (with certain exceptions) ...	159
IV.F.2. A relevant geographic market for all product markets is the United States	162
V. Google possesses substantial and sustained market power in the worldwide and US publisher ad server, ad exchange, and ad network markets	165
V.A. Sources of Google's market power over its ad tech products	170
V.A.1. Google's key strategic assets	170
V.A.2. Economic factors that increase barriers to entry and expansion	173
V.B. Google possesses substantial and sustained market power in the publisher ad server market.....	175
V.B.1. Sources of Google's market power in the publisher ad server market	175
V.B.2. Indirect evidence of Google's market power in the publisher ad server market	178
V.B.3. Direct evidence of Google's market power in the publisher ad server market.....	187
V.C. Google possesses substantial and sustained market power in the ad exchange market	192
V.C.1. Sources of Google's market power in the ad exchange market.....	193
V.C.2. Indirect evidence of Google's market power in the ad exchange market.....	195
V.C.3. Direct evidence of Google's market power in the ad exchange market	207
V.D. Google possesses substantial and sustained market power in the advertiser ad network market.....	218
V.D.1. Sources of Google's market power in the advertiser ad network market	219
V.D.2. Indirect evidence of Google's market power in the advertiser ad network market	220
V.D.3. Direct evidence of Google's market power in the advertiser ad network market.....	224
VI. Economic framework for analyzing Google's conduct in the ad tech stack	232
VII. Google has historically engaged in, and continues to engage in, conduct within and across the relevant markets that excluded and harmed the competitiveness of rivals and potential entrants	239
VII.A. Google's ad tech strategy and importance of DFP	244
VII.A.1. Google's ad tech strategy and the importance of the publisher ad server	244
VII.A.2. Threats to Google's substantial market power in ad tech and DFP	247
VII.B. Google provided unrestricted access to Google Ads exclusively to AdX, thereby foreclosing rival exchanges from access to Google Ads' advertiser demand	252

Expert Report of Robin S. Lee, PhD

VII.B.1. Access to Google Ads' advertiser demand affects the competitiveness of an ad exchange	253
VII.B.2. Google's bidding relationship between Google Ads and AdX foreclosed rival exchanges, enhancing AdX's market power and ability to maintain high fees	254
VII.B.3. Google's AWBid program did not prevent rival ad exchanges from being foreclosed from Google Ads' demand	257
VII.C. Google provided access to and use of real-time bids from AdX exclusively to DFP, thereby foreclosing rival publisher ad servers' access to real-time bids from AdX	262
VII.C.1. Real-time bids from exchanges are highly valuable for publishers	264
VII.C.2. Providing real-time bids from AdX exclusively to DFP discouraged the use of rival publisher ad servers	265
VII.C.3. Accessing AdX through rival publisher ad servers is meaningfully limited	267
VII.D. Google used DFP's substantial market power to deny rival exchanges advantages provided to AdX and interfere with publishers' ability to work with rivals	273
VII.D.1. Google exclusively provided AdX with Dynamic and Enhanced Dynamic Allocation, denying "first look" and "last look" advantages to rival exchanges	273
VII.D.2. Google prevented publishers from setting variable pricing floors, weakening competitive pressures on AdX and impeding publisher's ability to sell impressions through rival exchanges ..	285
VII.E. Google's acquisition of AdMeld	293
VII.E.1. Google acquired AdMeld in response to a perceived threat from yield managers	293
VII.E.2. Google's acquisition of AdMeld eliminated a competitor and option for publishers to manage multiple demand sources	300
VII.F. Google's conduct excluded rivals and harmed their ability to compete for advertiser spending and publisher impressions in the relevant markets	302
VII.F.1. Google's conduct materially harmed rival ad exchanges' ability to compete for advertiser spending and publisher impressions	305
VII.F.2. Google's conduct materially harmed rival publisher ad servers' ability to compete for publisher impressions	315
VII.F.3. Google's conduct materially harmed rival advertiser ad networks' ability to compete for advertiser spending and publisher impressions	324
VIII. Google's conduct maintained and enhanced its substantial market power and materially harmed competition	327
VIII.A. Google's conduct maintained and enhanced its market power and harmed open-web publishers and advertisers	329
VIII.A.1. Google's conduct sustained materially higher fees in the advertiser ad network and exchange markets and facilitated the exercise of greater market power in the publisher ad server market, thereby harming open-web publishers and advertisers	329
VIII.A.2. Google's conduct likely reduced choice for, and the quality of matches between, advertisers and open-web publishers	337
VIII.A.3. Google's conduct likely reduced innovation and entry in the ad tech stack	342
VIII.B. Google's conduct likely harmed consumers	345
VIII.B.1. Reduced publisher payouts from open-web display advertising likely reduces the quality and quantity of online content	345
VIII.B.2. Higher fees charged for open-web display advertising can lead to higher retail prices	348

Expert Report of Robin S. Lee, PhD

Appendix A. Curriculum vitae.....	A-1
Appendix B. Materials relied upon	B-1
Appendix C. Additional industry and market background.....	C-1
Appendix D. Additional market shares figures	D-1
Appendix E. Additional take rate and margin figures	E-1
Appendix F. Additional Section VII.F figures.....	F-1
Appendix G. Line charts.....	G-1
Appendix H. Data appendix	H-1
Appendix I. Economics of tax incidence.....	I-1
Appendix J. Technical appendix	J-1
Appendix K. Additional Google ad tech products and features	K-1
Appendix L. Background for Google’s Conduct	L-1
Appendix M. Glossary.....	M-1

List of figures

Figure 2. Diagram of Google's exclusionary conduct.....	11
Figure 3. Revenue share by type of advertising media in the United States (2021).....	14
Figure 4. US and worldwide digital advertising spend trends (2011–2022)	15
Figure 5. Examples of common display ad locations as specified by the Internet Advertising Bureau (IAB)	17
Figure 6. Examples of display ads shown on websites	18
Figure 7. Examples of search ads.....	19
Figure 8. Example of digital instream video ad formats as specified by the Internet Advertising Bureau.....	20
Figure 9. Example of content recommendation displayed below site content	22
Figure 10. Example of Google's Multiplex content recommendation advertising on desktop.....	22
Figure 11. Example of sponsored listing ads alongside organic listings on Ebay	23
Figure 12. Example of in-feed social native ads shown on Facebook.....	25

Expert Report of Robin S. Lee, PhD

[REDACTED]

Expert Report of Robin S. Lee, PhD

[REDACTED]

Expert Report of Robin S. Lee, PhD

[REDACTED]

Expert Report of Robin S. Lee, PhD

[REDACTED]

Expert Report of Robin S. Lee, PhD

[REDACTED]

I. Introduction

I.A. Qualifications

- (1) I am an economist, specializing in the field of industrial organization. Industrial organization studies the structure and functioning of markets, and competition among firms. I received my undergraduate and graduate degrees from Harvard University, receiving my AB in Economics in 2003, my AM in Economics in 2005, and my PhD in Business Economics in 2008.
- (2) I am a Professor of Economics in the Department of Economics at Harvard University and regularly teach courses in industrial organization to graduate and undergraduate students. Previously, I have served on the faculty at New York University's Stern School of Business where I taught MBA students. I have published thirteen articles in peer-reviewed journals, including the *American Economic Review*, *Econometrica*, and the *Journal of Political Economy*. My published work has examined issues related to competition in a variety of industries characterized by network effects. I have also coauthored a chapter covering empirical analysis of contracting in vertical markets that appeared in the most recent volume of the Handbook of Industrial Organization (Elsevier, 2021). I have served as a Co-Editor of the *American Economic Journal: Microeconomics* and as an Associate Editor of the *International Journal of Industrial Organization*, both of which are leading journals in the field of industrial organization.
- (3) In my academic positions at New York University and Harvard University, I have supervised the thesis research and served on the dissertation committees of 25 economics PhD candidates. I have received several awards of recognition for my academic work, including the Econometric Society's Frisch Medal (an award presented biennially for the best applied paper published in *Econometrica*), the American Antitrust Institute's award for Best Antitrust Article on Mergers, and the Association of Competition Economics' Best Paper Prize.
- (4) I have served as an economic expert on several antitrust matters in the past.
- (5) My curriculum vitae is Appendix A to this report. It contains additional information about my professional experience, including my publications and prior testifying experience.

I.B. Scope of charge

- (6) I have been retained by the United States Department of Justice on behalf of Plaintiffs in this case. Plaintiffs allege that the Defendant, Google, "has used anticompetitive, exclusionary, and unlawful

means to eliminate or severely diminish any threat to its dominance over digital advertising technologies.”¹

- (7) I have been asked by counsel at the Department of Justice to undertake certain economic analyses associated with questions of market definition, market power, and competitive effects raised by the allegations of the complaint:
- Determine whether publisher ad servers, ad exchanges, and advertiser ad networks for open-web display advertising, both worldwide (excluding countries like the People’s Republic of China that substantially restrict internet access) and in the United States, are relevant antitrust markets for the purpose of evaluating Google’s market power and alleged anticompetitive conduct.²
 - Assess whether Google has possessed market power in those markets and, if so, assess the extent of Google’s market power.
 - Determine, as a matter of economic principles, whether Google’s conduct (i) was or is likely to result in the creation, extension, or maintenance of market power in the publisher ad server, ad exchange, and ad network markets, (ii) was or is harmful to competition, and (iii) was or is likely to result in material harm to open-web publishers, advertisers, and consumers.

I.C. Materials relied upon

- (8) In my work on this matter, I was assisted by a staff of expert economists and economic analysts at the consulting firm Bates White LLC. I directed the activities of the team, supervised and made all final decisions concerning economic analyses and their implementation, and prepared this report.
- (9) My team and I were provided with access to materials, including documents, data, and deposition transcripts produced in this matter. I instructed my team to identify information relevant for my review including information regarding Google’s ad tech products and related markets, the activities of Google and its rivals in those markets, and factors that influenced market outcomes. I instructed my team to identify materials for my review regardless of whether they appeared to support the positions of the Plaintiffs or Google.
- (10) In forming my opinions, in addition to my training, teaching, research, and experience, I relied on the materials identified throughout this report. To the extent that I have referenced or relied on documents and testimony in this report, I have done so to ensure that my economic analyses and application of economic principles are based on an understanding of the underlying facts. I do not offer expert opinions on the meaning of individual documents. Appendix B contains a detailed list of materials

¹ Amended Complaint, United States, et al. v. Google LLC, No. 1:23-cv-00108-LMB-JFA (E.D. Va. Mar. 14, 2023) (hereinafter, “Amended Complaint”).

² Amended Complaint, ¶¶ 279–303.

that I relied upon in forming my opinions. I reserve the right to incorporate new materials or data into my analysis, if and when they become available.

- (11) Bates White is compensated at a rate of \$765 per hour for my work in this matter. Neither Bates White's compensation nor my compensation is in any way contingent on the outcome of this case.

I.D. Summary of opinions

- (12) I have reached the following opinions in this matter:
1. Publisher ad servers, ad exchanges, and advertiser ad networks that serve and transact open-web display advertising are relevant antitrust product markets for evaluating Google's market power and the competitive effects of the conduct that is the focus of my report. For each relevant product market, both worldwide (excluding a limited number of countries and regions, including the People's Republic of China) and the United States are relevant geographic markets.
 2. Google possesses substantial market power in each of the relevant markets, protected by significant barriers to entry. It has possessed that market power in each of the relevant markets in recent years, and likely since at least 2015.
 3. Google has used its market power within and across the relevant markets to exclude competitors from participating in these markets, and to impede their ability to compete for customers. Google has done so by:
 - (1) Providing unrestricted access to Google Ads' advertiser demand exclusively to its AdX ad exchange, and denying comparable access to rival ad exchanges;
 - (2) Providing access to and use of real-time bids from AdX exclusively to its DFP publisher ad server, and denying comparable access to rival publisher ad servers;
 - (3) Providing access to a feature known as "Dynamic Allocation" exclusively to AdX within DFP, granting AdX valuable "first-look" and "last-look" advantages over rival ad exchanges;
 - (4) Eliminating publishers' ability to use variable pricing floors within DFP, impairing their ability to work with rival ad exchanges and exert competitive pressures on AdX;
 - (5) Acquiring an emergent competitor, AdMeld, and eliminating it as a competitive threat to Google's AdX and DFP products.
 4. These actions have harmed and continue to harm the ability of rival publisher ad servers, ad exchanges, and advertiser ad networks to compete for advertiser spending and publisher impressions. These actions have also denied scale to Google's rivals in each of the relevant markets, which is important for the competitiveness of ad tech products.

5. Google's actions harm competition and have enhanced and maintained Google's market power in the relevant markets. Google's actions have also harmed open-web display publishers and advertisers, and have also likely harmed consumers.

I.E. Summary of report

- (13) Competition encourages firms to provide higher quality and lower priced products, and to innovate and adapt in ways that create customer value. For these reasons, competition policy in the United States seeks to preserve competition by prohibiting firms from using their established dominance to distort or impede competition and block competitive threats from rivals, while preserving incentives to improve products in ways that benefit customers.
- (14) *Monopolization* refers to conduct that creates or maintains a firm's substantial market power over its products by harming competition. The most common methods of monopolization undermine the ability of customers to transact freely with rivals, and the ability of rivals to serve those customers' needs. These methods typically exclude rivals from competing for segments of a market by hindering customers from using their products, depriving them of or degrading access to important inputs, raising their costs of operation, or worsening the quality of their products.
- (15) In this report, I conduct an economic inquiry into whether Google has engaged in (and continues to engage in) conduct that harmed competition and served to acquire, maintain, or enhance Google's market power over technology products used to transact open-web display advertising on websites ("ad tech products"). The customers potentially impacted by its actions are *open-web publishers* (website operators that do not own and operate their own ad-tech products) and *advertisers* seeking to transact open-web display advertising.
- (16) My economic inquiry involves four steps:
 1. First, determining whether Google's conduct excluded existing or potential rivals from, or impeded their ability to compete for, publisher impressions and advertiser spending, thereby harming their competitiveness;
 2. Second, evaluating whether Google's conduct preserved or enhanced Google's market power;
 3. Third, evaluating whether Google's conduct has harmed customers (open-web publishers and advertisers);
 4. Last, examining whether pro-competitive justifications for the scrutinized conduct exist. If so, then investigating whether any pro-competitive benefits could have been realized via less-restrictive or less-exclusionary means (in which case such benefits are not specific to the

II.A.1. Ad tech products for display advertising and their customers

- (51) “Ad tech,” short for advertising technology, refers to software and other tools used to purchase, sell, and manage digital display advertising. I refer to companies offering ad tech products as ad tech intermediaries.
- (52) [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED] Because advertisers are buyers and publishers are sellers of display ad inventory, advertisers are said to be on the “demand-side” (or “buy-side”) while publishers are on the “supply-side” (or “sell-side”).
- (53) A variety of ad tech products work in conjunction with one another to facilitate display advertising transactions between publishers and advertisers. These products form what is known as the “ad tech stack.” At a high level, the ad tech stack can be described as comprising three “layers” consisting of ad tech products that each serve different functions:
- publisher ad servers;
 - ad exchanges; and
 - advertiser bidding tools, comprising both demand-side platforms (“DSPs”) and advertiser ad networks.²⁹
- (54) The purchase of a single online display ad “impression” (i.e., a single display ad shown to a single web visitor) by an advertiser from a publisher often involves participation by products in each of these layers. I describe these ad tech products in more detail in Section II.B.
- (55) The focus of this report is ad tech products for display ads that are shown on websites, so unless otherwise specified, I will use the term *publishers* to refer to entities that operate online web pages and display content to web visitors. These publishers often monetize their web traffic by devoting some of the space on their web pages to display advertising. I will use the term *open-web publishers* to refer to those publishers that rely on third-party ad tech products (i.e., products that these publishers do not themselves own) to sell their display ad inventory.³⁰ [REDACTED]
[REDACTED]

²⁸ There are some forms of display ads that do not appear on websites, a notable example being in-app display ads. As I explain in Section IV, in-app ads are a distinct form of advertising from open-web display ads. Google also distinguishes between display, video, and in-app inventory. [REDACTED]

²⁹ Certain ad networks can also be used to connect advertisers and publishers without relying on exchanges or publisher ad servers. See Section II.B.2.b.

³⁰ Unless otherwise specified, I use “publishers” in this report to mean “open-web publishers,” as these are the publisher customers of the ad tech products that are the focus of this report.

[REDACTED]

- (56) In my report, I use “open-web display advertising” to refer to display ads shown on the websites (which can be viewed on desktop or mobile devices) of open-web publishers. This excludes other forms of digital advertising (including search and instream video), and display ads that are shown in applications used on mobile devices or on TV media players.³² Similarly, unless otherwise specified, I use the term *advertisers* in this report to refer to entities that purchase display advertising inventory.
- (57) Even though website visitors and hence viewers of display ads (“users” or “consumers”) are not direct customers of ad tech products, they too can be affected by changes in the quality or cost of display advertising. For example, users may benefit if display ads become more “relevant,” which can mean that ads more frequently contain valuable information for consumers. They may also benefit if increased monetization from display advertising allows publishers to fund the creation of new content. On the other hand, users can be made worse off if display advertisements become less relevant, rely on more personal data, become more expensive and lead to higher final prices of goods or services, or if publishers earn less from the sale of online display inventory and therefore are less able to produce valuable content.

II.A.2. Uses of different forms of digital advertising

- (58) [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED] These and other roles played by advertising are often described by marketers as corresponding to different stages of a consumer’s “journey” toward making a purchase. Marketing

³¹ [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

³² Apple and Android smartphones and tablets are examples of mobile devices, and Roku, AppleTV, Amazon’s Fire TV, and Google’s Chromecast are examples of TV media players.

³³ Philip Kotler and Kevin Lane Keller, *A Framework for Marketing Management*, 6th ed. (Pearson Education, 2016): 122. (“Some people are unaware of the product, some are aware, some are informed, some are interested, some desire the product, and some intend to buy... [M]arketers can employ a marketing funnel to break the market into buyer-readiness stages.”). [REDACTED]

[REDACTED] See also Amazon Ads, “What is a marketing funnel? How they work, stages, and examples,” Amazon Ads, accessed December 18, 2023, <https://advertising.amazon.com/library/guides/marketing-funnel> (describing a “four-stage marketing funnel” including the stages of “awareness, consideration, conversion, and loyalty.”)

(101) [REDACTED]

(102) Ad networks, like Google’s Display Network with *AdSense*, may also have a publisher-facing component used by open-web publishers to sell display inventory. I describe AdSense in further detail in Section II.C.3.b below.

II.B.3. Ad exchanges

(103) Ad exchanges (also previously referred to as supply side platforms, or “SSPs”) are software products that run real-time auctions for publishers’ display ad inventory.^{114, 115} Publishers can sell display ads through ad exchanges via a publisher ad server, and advertisers can bid on those impressions using DSPs and advertiser ad networks.

(104) [REDACTED]

¹¹² A 2018 Google document describes Criteo as a “[c]ompetitive performance ad network” and lists Facebook Ads (no longer active in open-web display) as the only other display ad network competitor. *See* [REDACTED] *See* Section V.D.

¹¹³ Allison Schiff, “Facebook is Killing Off Its Web Supply In Audience Network – And Don’t Be Surprised If It All Shuts Down,” *adexchanger*, February 5, 2020, <https://www.adexchanger.com/platforms/facebook-is-killing-off-its-web-supply-in-audience-network-and-dont-be-surprised-if-it-all-shuts-down/>. *See also* Meta, “Changes to Web and In-stream Placements,” <https://www.facebook.com/business/help/645132129564436>; Meta, “Meta Audience Network,” <https://www.facebook.com/audiencenetwork/> and discussion in Section V.B.2.b.

¹¹⁴ While previously distinct, SSPs and ad exchanges today are often used to refer to the same set of products. GOOG-DOJ-04429792 (“Monetization Cheatsheet” presentation) at -795 (03/27/2017) (“Sell Side Platform (SSP)/Exchange – service for managing multiple programmatic monetization sources of online display inventory, DSP and ad networks are considered ‘Buyers’, and publishers and publisher networks are considered ‘Sellers’. Google Exchange is called AdX”).

[REDACTED] Often SSP and Exchange are bundled as one product and both names are used interchangeably”); Ryan Joe, “Defining SSPs, Ad Exchanges and Rubicon Project,” *AdExchanger*, Feb. 7, 2014, <https://www.adexchanger.com/yield-management-tools/defining-ssps-ad-exchanges-and-rubicon-project/> (“The distinction between an ad exchange and a supply-side platform (SSP) has become muddled as the once disparate but complementary technologies have merged.”). *See also* Michal Wlosik and Maciej Zawadzinski, “What is a Supply-Side Platform (SSP) and How Does It Work?,” *Clearcode*, October 18, 2018, <https://clearcode.cc/blog/what-is-supply-side-platform/>.

¹¹⁵ While certain exchanges such as Google’s AdX have begun to facilitate programmatic direct transactions, ad exchanges have primarily fulfilled indirect deals via RTB auctions. In 2022, fewer than 4% of impressions and less than 14% of spend transacted by exchanges that produced data sufficient to identify transaction type in this matter were transacted through direct transactions.

¹¹⁶ [REDACTED]

[REDACTED]

(105)

[REDACTED]

[REDACTED]

(106)

[REDACTED]

117 [REDACTED]

[REDACTED] *See also* Irina Kovalenko, “What is an Ad Exchange?,” Programmatic 101, January 30, 2017 <https://smartyads.com/blog/what-is-an-ad-exchange/>.

119 Google, “Protections overview,” Google Ad Manager Help, accessed December 18, 2023, <https://support.google.com/admanager/answer/2913553>.

120 [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED] Section III.E for additional detail.

121 [REDACTED]
[REDACTED]
[REDACTED]

122 [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

(107) [REDACTED]

II.C. Google's ad tech products

(108) In this Section, I describe Google's publisher ad server, ad exchange, ad network, and DSP products.

- In Section II.C.1, I describe DFP, Google's publisher ad server.
- [REDACTED]
- In Section II.C.3, I describe Google Ads and AdSense, which are the advertiser- and publisher-facing components of the Google Display Network.
- In Section II.C.4, I describe DV360, Google's DSP.

(109) Last, in Section II.C.5, I briefly describe other products that Google owns that facilitates the sale of digital display advertising, including its advertiser ad server, Google Campaign Manager, and its data analytics product, Google Analytics.¹²⁵

II.C.1. DoubleClick for Publishers (DFP)

(110) [REDACTED]

¹²³ [REDACTED]

¹²⁴ In June 2018, Google introduced Google Ad Manager (GAM) which combined DFP and AdX. Jonathan Bellack, "Introducing Google Ad Manager," Google Ad Manager, Jun. 26, 2018, <https://blog.google/products/admanager/introducing-google-ad-manager/>. See Appendix K.1 for further detail on GAM. There is still a distinction between AdX and DFP. See e.g., [REDACTED]

¹²⁵ I also describe its AdMob product which focuses on in-app advertising,

¹²⁶ Historically there have been two versions of DFP (DFP Premium and DFP Small Business) that differed in pricing and features. Currently, GAM 360 and GAM include these products. See, e.g., [REDACTED]

[REDACTED] See also Google, "Repost: Publishers are succeeding on DFP," DoubleClick Publisher Blog, October 29, 2012, <https://doubleclick-publishers.googleblog.com/2012/10/> ("We announced DFP two years ago with the goal of helping publishers open doors to new revenue. Since then, thousands of our smaller publishers have switched to DFP for Small Business and hundreds of our largest partners to DFP Premium."). See also [REDACTED]

[REDACTED]; See Section II.D for a description of DFP pricing.

Second, even among the set of advertising options available to a publisher given its content, there is significant differentiation between display advertising and other forms of advertising.

IV.B.1.a.i. Publishers' advertising options are limited by the content they provide

(268) A publisher's options for using advertising to monetize a particular piece of online content is limited by the nature of the content itself.

(269) Perhaps most obviously, a publisher with *online* content cannot generally sell *offline* advertising to directly monetize that online content. Similarly, publishers cannot monetize their *web* properties by selling *in-app* ads.³⁵⁴ Offline and in-app ads fundamentally monetize different advertising inventory than web ads.

(270) [REDACTED]

IV.B.1.a.ii. Display advertising is differentiated from other available options from a publisher's perspective

(271) Even for publishers who have advertising options other than display advertising for the content they offer, display advertising is significantly differentiated from other forms of digital advertising.

(272) **Instream Video.** [REDACTED]

³⁵⁴ Many online publishers also do not have a mobile app: Google data show that in 2022, 83% of AdX web publishers sold no mobile app or tablet app impressions (Google XPP-D data (DOJ RFP 7)). This figure excludes transactions where Google sold its owned-and-operated inventory through AdX.

³⁵⁵ [REDACTED]

[REDACTED]

(273) [REDACTED]

(274) These price differences are consistent with instream video and display ads not being close substitutes from publishers' perspectives, and there being constraints on publishers' abilities to re-allocate their advertising space away from display ads and toward instream video ads to take advantage of the higher monetization rate.

(275) **In-app.** As discussed above, even for publishers that have both a mobile application and a web site, in-app and open-web display advertising are not close substitutes. This is primarily because *in-app* display ads cannot monetize the publisher's *web* inventory (and vice versa); such a publisher would likely use both in-app and open-web display ads if it chose to monetize its digital properties with display advertising. Additionally, web impressions and app impressions for such publishers may attract different audiences and users.³⁵⁹ [REDACTED]
[REDACTED] Forgoing open-web advertising would mean forgoing additional advertising sales for those web impressions.

356 [REDACTED]

357 [REDACTED]

358 [REDACTED]

³⁵⁹ See Section II.A.2, IV.B.1.a, IV.B.2.b.

³⁶⁰ Google XPP-D data (DOJ RFP 7).

(276) **Native.** [REDACTED]
[REDACTED]
[REDACTED]

(277) [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED] Similarly, in-feed native ads are distinct from display ads because they occupy slots *within* (as opposed to above and around) publishers' content.³⁶³

(278) [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

361 [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

362 [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

363 See Section II.A.

364 [REDACTED]
[REDACTED]
[REDACTED]

365 Google, "About ad units," Google AdSense Help, <https://support.google.com/adsense/answer/9183549>. See also [REDACTED]
[REDACTED]
[REDACTED] Per Google, "Traffic Multiplex ads (retired)," Google Ad Manager Help, <https://support.google.com/admanager/answer/9428537?hl=en>, (Multiplex was

[REDACTED]

IV.B.1.b. Open-web publishers cannot easily substitute to selling display advertising inventory with their own integrated advertising tools

- (279) Open-web publishers rely on third-party ad tech products to sell their ad inventory. [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]

retired in July 2023).

366 [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

369 [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

370 [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

- (418) Dr. Respass calculates that Google's operating profit in the DVAA product area (excluding AdMob) increased from \$312 million in 2020 to \$1.185 billion in 2022.⁵⁹¹ Dr. Respass's calculations also show negative accounting profits from 2015–2017. As a general matter, negative accounting profit (which are not based on economic opportunity costs) does not rule out the possession of substantial market power. For example, firms with substantial market power may invest profits today in order to entrench their market power and recover greater returns in the future.⁵⁹²
- (419) Given the general difficulties in comparing economic profits and accounting profits discussed above, and the challenges with mapping Google's profits to the products contained in the relevant markets at issue in this matter, I do not rely on measures of accounting profit and instead rely on other indirect and direct evidence to evaluate Google's market power in the relevant markets.

V.A. Sources of Google's market power over its ad tech products

- (420) Because each of the relevant markets that I evaluate in this report are intertwined, and Google's market power in the relevant markets in part flows from Google's assets that lie both within and outside these markets, I begin by discussing key sources of Google's market power across the ad tech stack. I then discuss common economic factors that increase barriers to entry in each of the relevant product markets.

V.A.1. Google's key strategic assets

- (421) Google's substantial market power for its ad tech products derives from several key strategic assets that Google has leveraged within the ad tech stack. The presence of indirect network effects has amplified the importance of these assets.

[REDACTED]

⁵⁹² See Section VII.A.

(422)

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] (I discuss the importance of Google Ads' demand further below in Section V.D and in VII.B.)

(424) Third, DFP's publisher customers are "sticky" because it is very disruptive for them to change ad servers. The stickiness of publisher ad servers was recognized at the time of Google's DoubleClick acquisition.⁶⁰⁰ Through the DoubleClick acquisition, Google obtained a publisher ad server that already had a significant share of publisher customers, and these sticky single-homing publishers helped Google gain and continue to maintain market power in the publisher ad server market and elsewhere in the ad tech stack. (I discuss the importance of DFP for Google's market power in Section VII.A.)

(425) [REDACTED]

[REDACTED]

598 [REDACTED]. See Figure 117 in Appendix F.

599 [REDACTED]

600 See Sections V.B.1, II.E.2, and Appendix L.1.

601 AdSense publishers only have access to Google Ads advertisers and select Google-certified Ad Exchange buyers. <https://support.google.com/admanager/answer/4599464?hl=en>. [REDACTED]

[REDACTED]

(426)

V.A.2. Economic factors that increase barriers to entry and expansion

(427) Particular economic features of the ad tech stack amplify the value of Google’s strategic assets and create barriers to entry and expansion for potential and existing competitors. These features include:

- **Indirect network externalities.** As discussed in Section III.D.1, products in the open-web ad tech stack exhibit indirect network externalities. For example, a successful ad exchange requires enough desirable display inventory to attract buyers to its auctions and enough attractive demand to induce publishers to supply their impressions. As I discuss further in Section VII.C, publishers value the unrestricted real-time access to Google Ads demand through AdX that is provided via

603 [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED] In a study crawling the top 1 million websites, Google Analytics third-party trackers appeared on about 70% of sites. Steven Englehardt and Arvind Narayanan, “Online Tracking: A 1-million site Measurement and Analysis,” Proceedings of the 2016 ACM SIGSAC Conference on Computer and Communications Security, 1388–1401, <https://dl.acm.org/doi/pdf/10.1145/2976749.2978313>. [REDACTED]

[illegible]

uses significant amounts of historical data from within the ad tech stack to forecast future traffic volumes and to dynamically set reserve prices (i.e., price floors) across exchanges within DFP.⁶²²

V.B.2. Indirect evidence of Google's market power in the publisher ad server market

- (436) Google's high market shares, as well as evidence of significant barriers to entry, provide indirect evidence of Google's substantial and sustained market power in the publisher ad server market.

V.B.2.a. Market shares

- (437) [REDACTED]
- (438) [REDACTED]

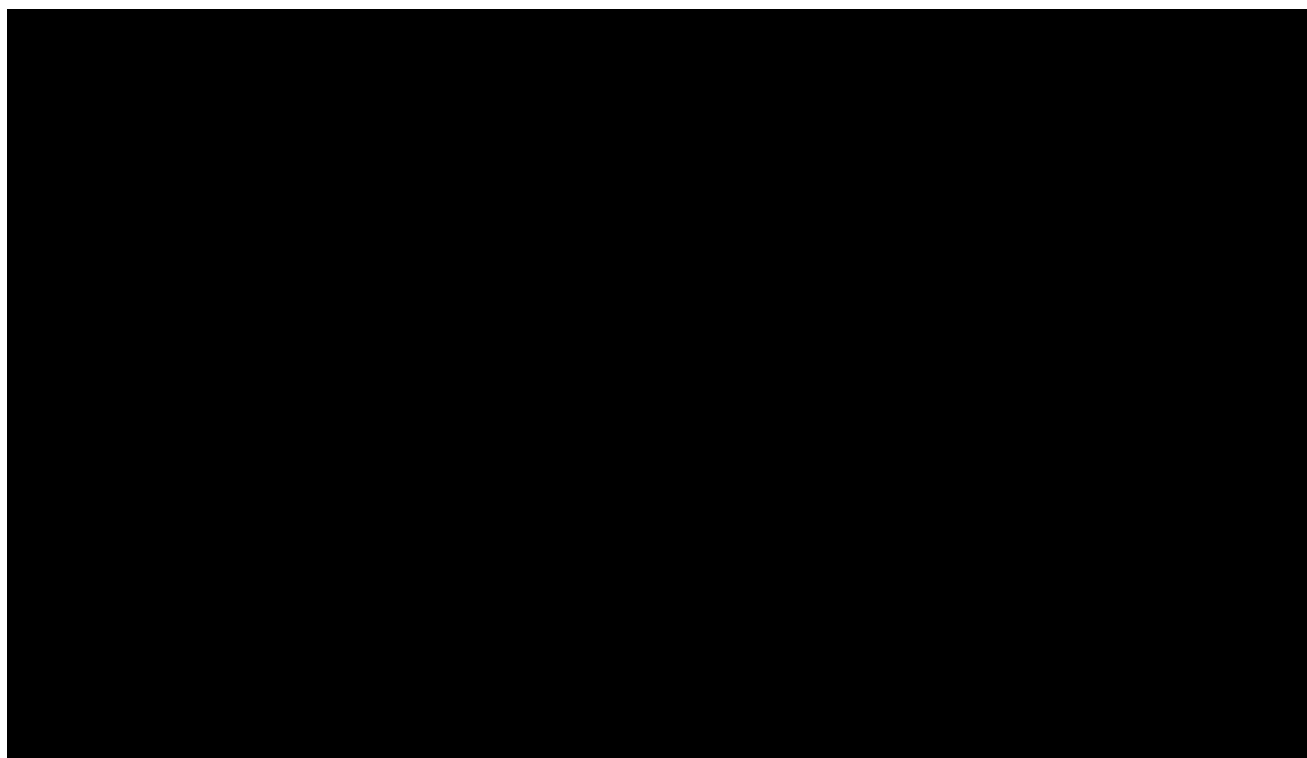
⁶²² See Section III.D.3 for further details.

⁶²³ [REDACTED]

⁶²⁴ [REDACTED]

⁶²⁵ [REDACTED]

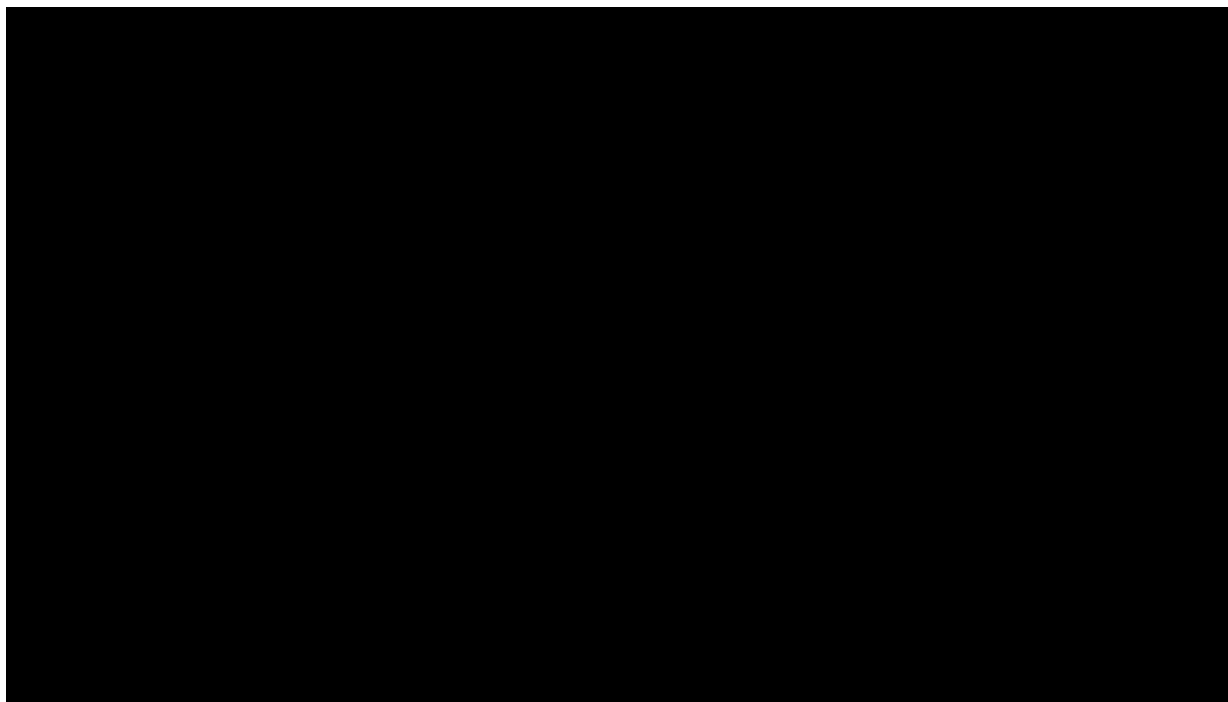
Figure 41. [REDACTED]
[REDACTED]



(439) [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

626 [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
627 [REDACTED]
[REDACTED]
[REDACTED]

Figure 42. [REDACTED]



(440) [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

628 [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

[REDACTED]

V.B.3.b. Google is able to significantly deviate from competitive behavior in the publisher ad server market

(461) Evidence that Google has substantial and sustained market power in the publisher ad server market includes its ability to meaningfully deviate from competitive behavior in that market without losing significant sales. In a competitive market, a firm loses significant sales if it degrades the quality of its product, all else equal.

(462) [REDACTED]

(463) [REDACTED]

(464) Indeed, Google's refusal to allow DFP customers to work on equal terms with rival exchanges as with AdX significantly contributed to the rise of header bidding, which became widely used in the 2014-2015 period.⁶⁷⁴ It is notable that during this period, when DFP did not offer publishers the ability to place AdX in competition with real-time bids from rival ad exchanges, publishers resorted to using header bidding (with its associated limitations and complications) rather than switch to another alternative publisher ad server.⁶⁷⁵ [REDACTED]

⁶⁷¹ See Section II.

⁶⁷² [REDACTED]

⁶⁷⁴ See discussion in Section II.E.3 and Appendix L.2.

⁶⁷⁵ See Sections II.E.3 and Appendix L.2 and L.3 for additional discussion of header bidding.

[REDACTED]

- (465) Moreover, as I described above, when Google made Open Bidding broadly available in 2018, it charged 5-10% for use of this functionality, more than the cost of alternative header bidding tools (as discussed above). In a more competitive market, a rival publisher ad server alternative that enabled publishers to access multiple ad exchanges in real-time would likely have restricted Google's ability to profitably levy such a fee.

V.C. Google possesses substantial and sustained market power in the ad exchange market

- (466) Google's ad exchange, AdX, is the largest ad exchange for open-web display transactions, and possesses substantial market power. In this section,
- I first describe how AdX's market power derives in large part from its advantaged treatment by Google Ads and DFP (Section V.C.1).
 - I then provide measures of AdX's market shares and discuss barriers to entry and expansion in the ad exchange market (Section V.C.2). AdX is by far the largest exchange in the ad exchange market across a variety of measures. Among worldwide indirect open-web display transactions, I calculate that AdX has maintained a share of over [REDACTED]. Barriers to entry and expansion include significant fixed costs of building, maintaining, and starting an ad exchange; and overcoming network effect and data disadvantages relative to incumbents.
 - Last, I provide direct evidence of AdX's market power (Section V.C.3). [REDACTED] Google's own analyses also indicate that Google could profitably raise AdX's take rate above competitive levels. Moreover, Google's conduct, including its ability to dynamically adjust reserve prices (starting in 2015) and use AdX to favor its own products in the ad tech stack even while degrading the quality of AdX by not submitting real-time bids into rival publisher ad servers, also demonstrate AdX's substantial market power. Such conduct would not be sustainable in a competitive market, as customers would substitute away to comparable alternatives to an extent to make this conduct unprofitable.
- (467) Substantial barriers to entry and expansion in the ad exchange market have protected Google's dominant position, and allowed it to maintain a high take rate and take actions that degrade AdX's

(480) Google's high share in the ad exchange market is also corroborated by data produced in this case. As I show below, market share measures are consistent with AdX possessing substantial and sustained market power in the exchange market.

(481) I present market shares based on impressions, or transactions served, by an ad exchange. As I discussed in Section III.D, via economies of scale and data, scale as measured by the volume of transactions handled by an ad tech product is important for an exchange's competitiveness.⁶⁹¹ [REDACTED]

[REDACTED] Although net revenue shares may reflect additional differences in ad tech products' ability to earn fees and returns on investment, they are less directly informative for competitive differences arising from scale effects.

(482) **Impressions.** [REDACTED]

(483) However, because I do not have access to data from all participants in the ad exchange market, the above share calculation does not contain transactions from those other ad exchanges and hence overstates AdX's share among all ad exchanges. To obtain a rough estimate of the number of transactions served through ad exchanges for which I do not have data, I perform the following calculation.⁶⁹⁴ First, I obtain the total number of worldwide indirect open-web display impressions that are purchased through ad exchanges from all bidding tools (DSPs and advertisers ad networks) that produced data sufficient to identify transactions by exchange. I compute that, in the years 2018 – 2022, the exchanges for which I have data represent approximately [REDACTED] [REDACTED] display transactions for this set of bidding tools, excluding DV360 and Google Ads (which meaningfully restrict bidding on non-Google ad exchanges). This figure is greater than [REDACTED] [REDACTED], although the ad exchanges that produced data comprise a substantial share of indirect

⁶⁹¹ [REDACTED]

⁶⁹² In Appendix D.1.c I also calculate spending (gross revenue) shares and show that they are similar to net revenue shares.

⁶⁹³ See Figure 88 in Appendix D.1.

⁶⁹⁴ I describe this calculation in more detail in Appendix H.

open-web display transactions, there is still likely a meaningful share represented by other ad exchanges.

(484) Following the approach outlined above, I am able estimate the total number of indirect open-web display impressions in each month transacted through ad exchanges that did not produce data using data produced by DSPs and advertiser ad networks.⁶⁹⁵ I use these estimates to supplement data produced by ad exchanges and am thus able to estimate the total number of indirect open-web display impressions transacted by ad exchanges in each month.

(485) [REDACTED]

⁶⁹⁵ To estimate the total number of open-web display impresions transacted through ad exchanges that did not produce data on this matter, I use data produced by DSPs and advertiser ad networks that contains [REDACTED]

⁶⁹⁶ [REDACTED]

Expert Report of Robin S. Lee, PhD

Figure 47. [REDACTED]
[REDACTED]

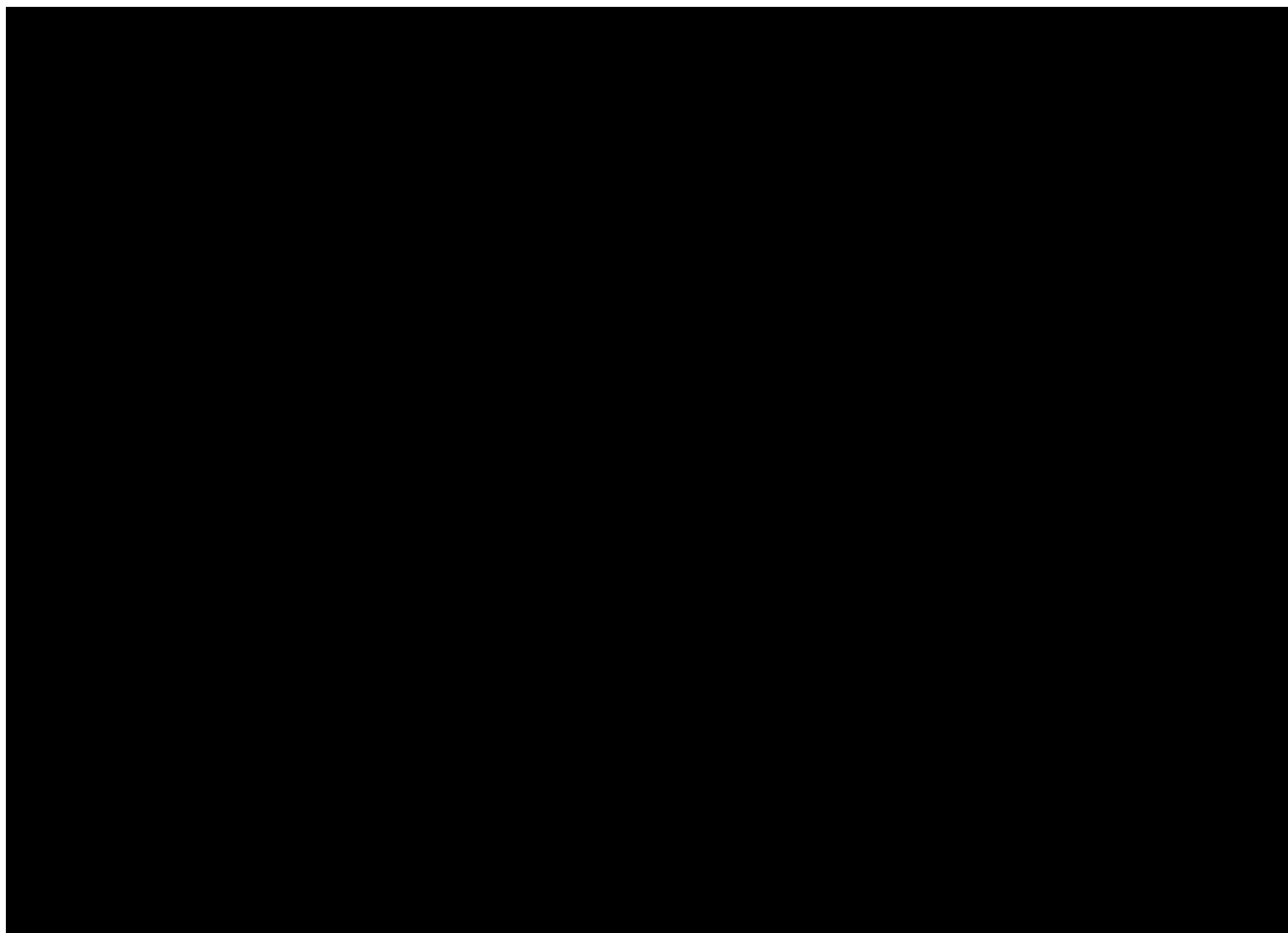
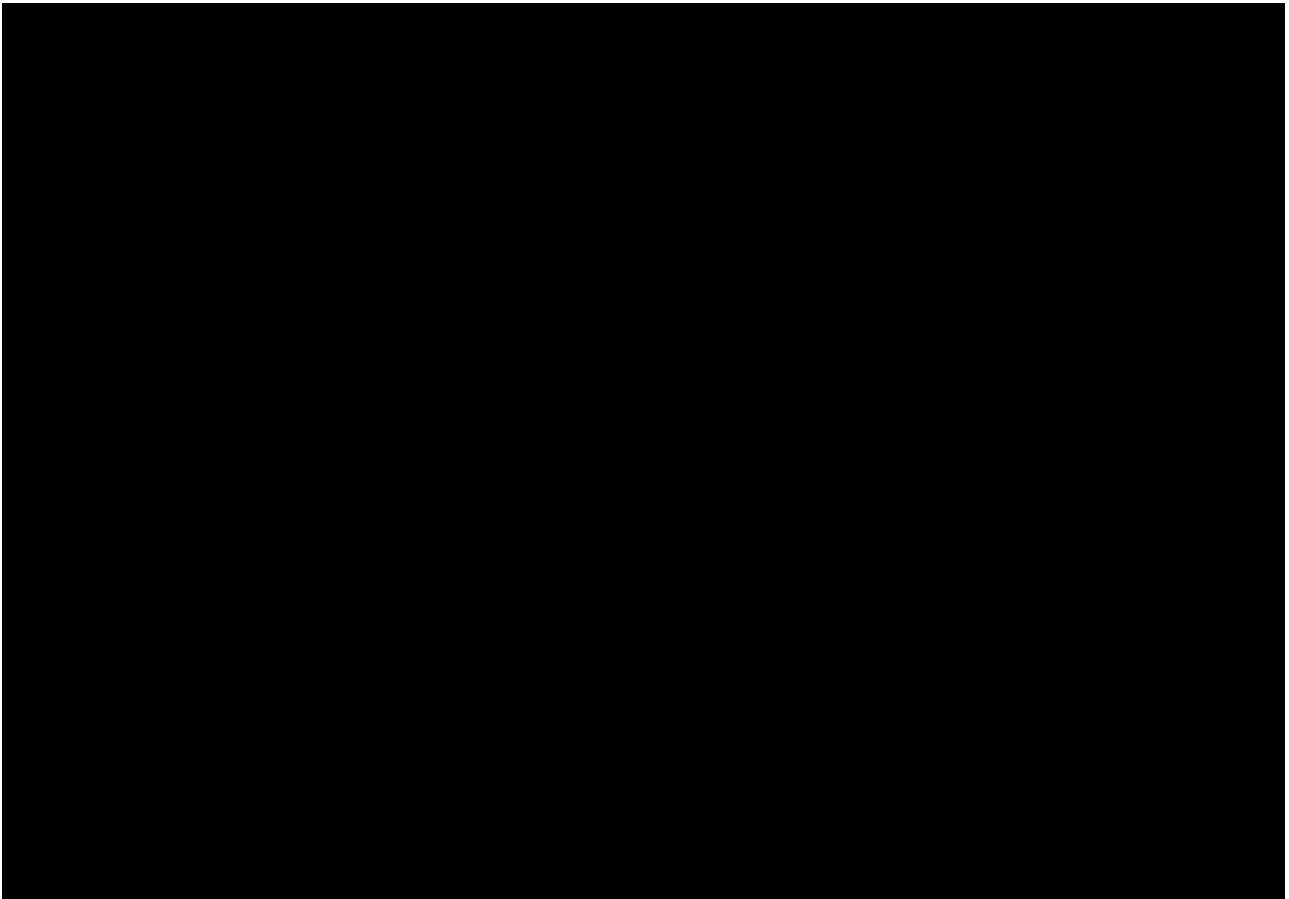


Figure 48. [REDACTED]



- (486) Due to data limitations, I am unable to compute reliable ad exchange market shares based on transactions restricted to ad exchange customer locations—i.e., based on transactions involving US open-web publishers or US advertisers.⁶⁹⁷ However, I am able to present market shares based on *user locations*—i.e., based on the location of the visitor to a publisher’s website. Such share calculations based on user locations can still be informative for at least two reasons.
- (487) First, publishers and advertisers in the US may particularly value ad tech products used to buy and sell display advertisements served to *users located in the US*. Consistent with this, a large fraction of open-web display transactions served by US publishers and purchased by US advertisers involve US users. [REDACTED]

⁶⁹⁷ Information on publisher and advertiser geographic locations are missing from data provided by many third-party ad exchanges, advertiser ad networks, and DSPs that produced data in this matter.

[REDACTED]

(488) Since advertisers and open-web publishers located in the US are thus likely to particularly value ad tech products that are able to effectively serve display ads to US users, an ad tech product's high market share over US users can inform the extent to which that product is attractive to US customers (i.e., US open-web publishers and US advertisers).

(489) Second, I am able to compare market shares based on user locations to those based on customer locations for a subset of exchanges whose data provide information on both publisher and user locations for indirect open-web transactions between 2020 – 2022. [REDACTED]
[REDACTED]. I find that impression and net revenue shares among this subset of exchanges are very similar across transactions involving US publishers *or* US users.⁷⁰⁰ Hence, even though market shares computed using transactions involving US users are not the same as those computed using transactions involving US publishers, this analysis suggests that they may be close.

(490) Having acknowledged these considerations, I calculate AdX's market share over transactions involving US users across a broader set of ad exchanges, and note that it is also high.⁷⁰¹ [REDACTED]

[REDACTED]
[REDACTED]
[REDACTED]³

(491) [REDACTED]
[REDACTED]

698 [REDACTED]

699 [REDACTED]

700 [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

701 To estimate the size of US-user impressions transacted by ad exchanges that did not produce data, I perform the following exercise: I first compute the the average ratio of impressions for US users relative to impressions for all users among ad exchanges who produced data with sufficient user-geography information. I then apply that average ratio to the estimate of total worldwide impressions for the exchanges who did not produce data at all or who did not produce data with US-user breakdowns. *See* Appendix H.

702 Figures depicting shares based on impressions from US users are contained in Appendix D.1.b.

703 [REDACTED]
[REDACTED]
[REDACTED]

[REDACTED]

(492) Note that Verizon (Yahoo) shut down its exchange product to open-web publisher inventory in 2023.⁷⁰⁵ Excluding Verizon's impressions from the ad exchange market size would provide AdX a 58% share of worldwide impressions and a 48% share of impressions from US users in 2022.⁷⁰⁶

(493) **Net Revenues (Fees).** [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

⁷⁰⁴ For robustness, I have analyzed AdX's market shares across several alternative specifications and find that these results are consistent. *See* Figure 89 in Appendix D.1.

⁷⁰⁵ Sara Fischer, "Exclusive: Yahoo to lay off more than 20% of staff as it shrinks ad biz," Axios, February 9, 2023, <https://www.axios.com/2023/02/09/yahoo-layoffs-2023-tech-media-companies>. *See also* YAH_GG_LIT_004590 (06/26/2023).

⁷⁰⁶ *See* Figure 88 and Figure 89 in Appendix D.1.a.

V.C.3.b. Google is able to significantly deviate from competitive behavior in the ad exchange market

(511) Evidence that Google has substantial and sustained market power in the ad exchange market includes its ability to meaningfully deviate from competitive behavior in that market.

(512) [REDACTED]

(513) Google limiting AdX's real-time bids into rival publisher ad servers is consistent with Google's ability to deviate from competitive behavior in the ad exchange market. I discuss this conduct further in Section VII.C.

(514) [REDACTED]

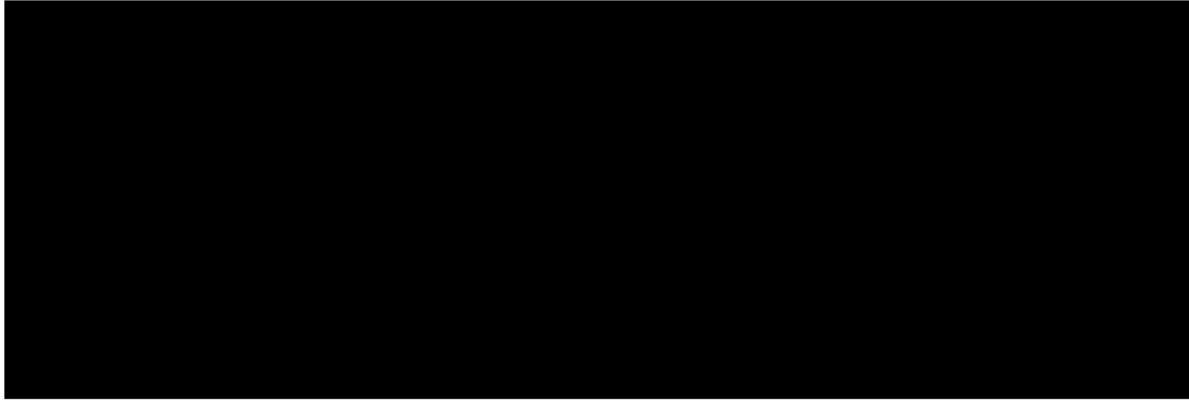
(515) [REDACTED]

⁷⁴² See Section VII.C on Google's exclusive provision of unrestricted access and use of real-time bids from AdX to DFP.

⁷⁴³ [REDACTED]

⁷⁴⁴ See [REDACTED]

⁷⁴⁵ [REDACTED]



- [REDACTED]

(520) For these reasons, I conclude that Google Ads has substantial market power in the advertiser ad network market, and has likely had such market power since at least 2015.

V.D.1. Sources of Google's market power in the advertiser ad network market

(521) Google Ads' dominant position in the advertiser ad network market derives in part from its access to unique advertising demand and publisher inventory, and its much larger scale than other competitors and potential competitors.

(522) **Unique advertising demand and publisher inventory.** Google Ads had a key advantage from its creation because of its exclusive access to valuable Google Search advertising inventory.⁷⁵⁶ [REDACTED]

[REDACTED]

⁷⁵⁶ In addition, a deal with AOL enabled AdWords advertisers to purchase search ads on AOL search listings and thereby granted AdWords and its customers access to AOL's then-34 million users. Christine Frey, "Overture Loses AOL Contract to Google," Los Angeles Times, May 2, 2002, <https://www.latimes.com/archives/la-xpm-2002-may-02-fi-overture2-story.html>. The deal propelled Google's search advertising business and by early 2003, Google touted the "largest and fastest growing" online advertising base in the industry, with over 100,000 advertisers. Google, Google News, "Google Builds World's Largest Advertising and Search Monetization Program," Google, March 4, 2003, <https://googlepress.blogspot.com/2003/03/google-builds-worlds-largest.html>.

⁷⁵⁷ [REDACTED]

⁷⁵⁸ See Section IV.E.1.

[REDACTED]

- (523) Today, Google Ads customers gain access to additional Google O&O inventory including YouTube that cannot be accessed through non-Google bidding tools,⁷⁶⁰ as well as access to open-web publishers using AdSense. [REDACTED]

[REDACTED]

- (524) **Scale and data.** [REDACTED]

V.D.2. Indirect evidence of Google's market power in the advertiser ad network market

- (525) Google's high market shares across a variety of measures, as well as evidence of significant barriers to entry, provide indirect evidence of Google's substantial and sustained market power in the advertiser ad network market.

⁷⁵⁹ See [REDACTED]

⁷⁶⁰ Advertisers can access YouTube and Google O&O inventory like Search via Google Ads. Google, "Grow your business with Google Ads," *Google Ads Help*, https://ads.google.com/intl/en_us/home/campaigns/video-ads/. See also Sections II.C.3 and V.A.1.

⁷⁶¹ See Figure 33 and Figure 38 in Section IV.E.1.a.

⁷⁶² See Figure 35 in Section IV.E.1.a. [REDACTED]

⁷⁶³ [REDACTED]

⁷⁶⁴ See Section III.D.

VII. Google has historically engaged in, and continues to engage in, conduct within and across the relevant markets that excluded and harmed the competitiveness of rivals and potential entrants

- (570) Over the last 15 years, Google has pursued a campaign to obtain, strengthen, and protect substantial market power throughout the open-web display ad tech stack. Although some of its market power may have been obtained through improvements to its existing products, Google has nonetheless engaged in other actions that have preserved its market power by acquiring or excluding rivals, and by frustrating and impeding their efforts to compete for customers.
- (571) In particular, Google has engaged in efforts to leverage its market power in one relevant market to strengthen its position in other markets. By using its position in one market to benefit its products in another, Google reduces demand (i.e., advertiser spending) or supply (i.e., publisher inventory) for rivals in the targeted market, both reducing the competitiveness of these rivals and the likelihood of entry of new ones. Moreover, because of indirect network effects and the need for different ad tech products to interoperate, reducing rivals' competitiveness in the targeted market also reduces the attractiveness of non-Google alternatives in other ad tech product markets.
- (572) In this Section, I examine the competitive effects of five actions that Google has undertaken with its ad tech products. I provide the basis for my opinion that these actions have harmed the competitiveness of rivals and their ability to attract advertiser spending and publisher inventory within the publisher ad server, ad exchange, and advertiser ad network markets. (Later, in Section VIII, I discuss how these actions have preserved and enhanced Google's market power and harmed customers and consumers.)
- (573) Before I examine the competitive effects of Google's five actions, I first provide background context for Google's conduct in Section VII.A.
- I provide an overview of Google's strategy in the ad tech stack since its acquisition of DoubleClick in 2008. This acquisition, which provided Google with its publisher ad sever (DFP) and ad exchange (AdX) products, laid the groundwork for Google's practice of using market power in one relevant market to foreclose rivals and distort competition in favor of its own products in another market. I describe as well the importance that Google placed on controlling the publisher ad server, allowing it to then further protect and enhance its market power across the ad tech stack.
 - I also describe how Google viewed yield managers and header bidding tools—which helped publishers access rival non-Google ad exchanges—as “disintermediation” threats to DFP's substantial market power. This discussion, as well as Google's varied responses, shows that

Google's efforts to impede and harm the competitiveness of rival ad exchanges not only had effects on competition within the ad exchange market, but also impacted competition within the advertiser ad network and publisher ad server markets and protected DFP's substantial market power. Moreover, the limited impact of these threats to Google highlights the durability of Google's entrenched position and market power, maintained and enhanced by the conduct described in the remainder of the Section.

(574) Next, I evaluate five actions taken by Google. In Sections VII.B and VII.C, I describe how following the acquisition of DoubleClick, Google established a Google-only pipeline through the heart of the ad tech stack, denying non-Google rivals the same access to real-time demand that it provided its own products, by providing:

- (1) Unrestricted access to Google Ads' advertiser demand exclusively to AdX;
- (2) Access to and use of real-time bids from AdX exclusively to DFP.

(575) In these instances, Google's actions denied or otherwise degraded rivals' access to a valuable asset that it controlled, and conditioned access to this asset on the use of its other products.⁸¹⁵ The bidding relationship between Google Ads and AdX foreclosed publishers who used a rival exchange from Google Ads' advertiser demand; this had the effect of diverting publisher inventory away from rival exchanges and towards AdX. Similarly, foreclosing rival publisher ad servers from access to real-time bids from AdX (whose own market power was enhanced by its preferred access to Google Ads) steered publishers towards DFP instead.

(576) Hence, Google used the market power it had in the advertiser ad network market with Google Ads to enhance AdX's market power in the ad exchange market, which in turn Google used to further strengthen and preserve DFP's market power in the publisher ad server market. Given Google Ads' and AdX's market power, Google possessed both the ability and evident incentive to engage in these actions. Such actions harmed the competitiveness of rivals in the relevant markets, ultimately to the detriment of advertisers and publishers.

(577) In Section VII.D, I describe how Google used DFP's market power, strengthened and preserved by the above conduct, to further advantage AdX over rival exchanges. It did so in at least two ways.

- (3) DFP granted AdX exclusive access among ad exchanges to its Dynamic Allocation and Enhanced Dynamic Allocation features (until the introduction of Exchange Bidding), thereby providing AdX with advantageous access to inventory over rival exchanges. AdX was thus

⁸¹⁵ In Sections VII.B.3 and VII.C.3, I discuss Google's AWBid feature, which allowed Google Ads to bid on rival exchanges for a subset of display impressions (albeit at a significantly higher targeted margin than it targeted on AdX), and Google's AdX Direct tag, which provided limited access to AdX to rival publisher ad servers. In both cases, I show that these features have meaningful restrictions, and that usage of these features is relatively small as a fraction of overall Ads or AdX transaction volume.

VII.A. Google's ad tech strategy and importance of DFP

- (583) This Section provides background and context for the evaluation of Google's exclusionary conduct examined in this report.

VII.A.1. Google's ad tech strategy and the importance of the publisher ad server

- (584) [REDACTED]
- (585) To help realize this objective and build up its open-web display advertising presence, Google purchased DoubleClick and its publisher ad server DFP in 2008,⁸¹⁷ formally introducing DoubleClick Ad Exchange (AdX) in 2009,⁸¹⁸ and later acquiring the DSP Invite Media in 2010⁸¹⁹ and yield manager AdMeld in 2011.⁸²⁰ With these pieces in place, Google restricted access to Google Ads' advertiser demand outside of its own "sell-side" products (AdX, AdSense, and DFP), and established an exclusive relationship between AdX and DFP. Both of these actions persist in some form today, and are described further below in Sections VII.B and VII.C.
- (586) By restricting access to demand from its valuable Google Ads product, Google was able to first attract and then lock in publishers to using its sell-side products, thereby providing it with the valuable display inventory with which to then attract additional advertising spend. Moreover, for reasons described in Section V.B, DFP's market power, once established, was protected due to significant

⁸¹⁶ [REDACTED]

⁸¹⁷ Eric Schmidt (then-Google Chairman and CEO), "We've officially acquired DoubleClick," *Google* (blog), Mar. 11, 2008, <https://googleblog.blogspot.com/2008/03/weve-officially-acquired-doubleclick.html>.

⁸¹⁸ Google News Announcement, "Google opens new DoubleClick Ad Exchange," News from Google, September 18, 2009, http://googlepress.blogspot.com/2009/09/google-opens-new-doubleclick-ad_18.html

⁸¹⁹ Neal Mohan (then Google Vice President of Product Management), "Investing in Exchange Bidding," *DoubleClick Advertising Blog*, Jun. 3, 2010, <https://doubleclick-advertisers.googleblog.com/2010/06/investing-in-exchange-bidding.html>.

⁸²⁰ Neal Mohan (then Google Vice President of Display Advertising), "Helping publishers get the most from display advertising with Admeld," *Google* (blog), Jun. 13, 2011, <https://googleblog.blogspot.com/2011/06/helping-publishers-get-most-from.html>.

switching costs publishers face in this market and publishers' tendency to use only a single publisher ad server for display advertising.

VII.A.1.a. The importance of the publisher ad server

(587) [REDACTED]

(588) [REDACTED]

(589) Google documents have described this strategy to “own the tag” with DFP, which would then benefit its other products (AdX and Google Ads), as follows:

- [REDACTED] (I discuss this conduct further in Section VII.D.1.)
- [REDACTED]

[REDACTED]

[REDACTED]

(590)

[REDACTED] As I noted in
Section V, [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

[REDACTED]

-
- [REDACTED]
 - [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
 - [REDACTED]
[REDACTED]
[REDACTED]
 - [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
 - [REDACTED]
[REDACTED]

In the years following the DoubleClick acquisition, [REDACTED]
[REDACTED]

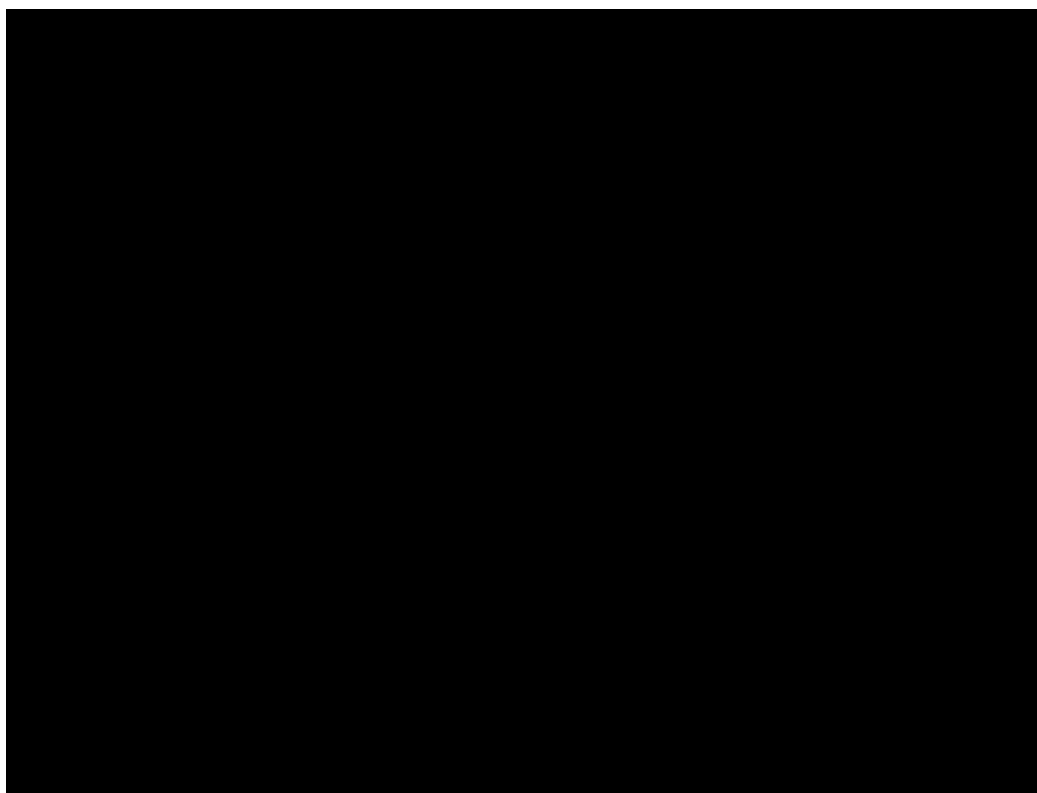
(594) [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

██████████ In Section VII.E, I describe ██████████ and discuss how Google responded by acquiring the yield manager AdMeld in 2011.

(595) Disintermediation, however, continued to be a concern. [REDACTED]

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

Figure 63. [REDACTED]



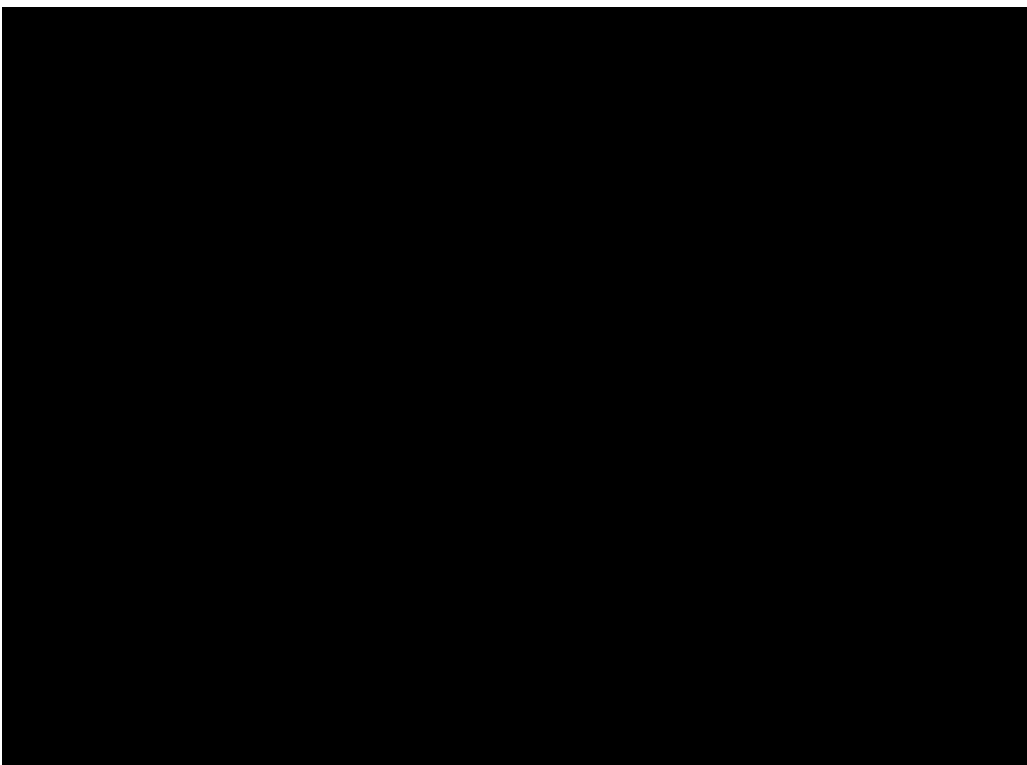
(596) The next slide in the presentation, shown in Figure 64, [REDACTED]

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

-
- [REDACTED]
 - [REDACTED]
 - [REDACTED]

[REDACTED]

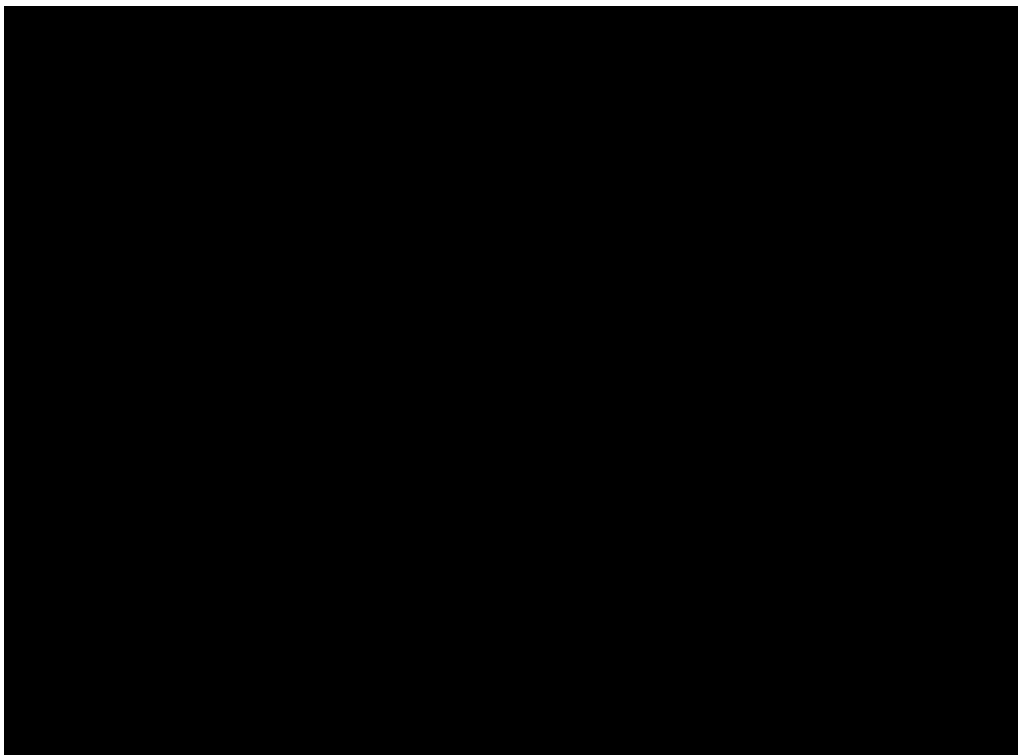
Figure 64. [REDACTED]



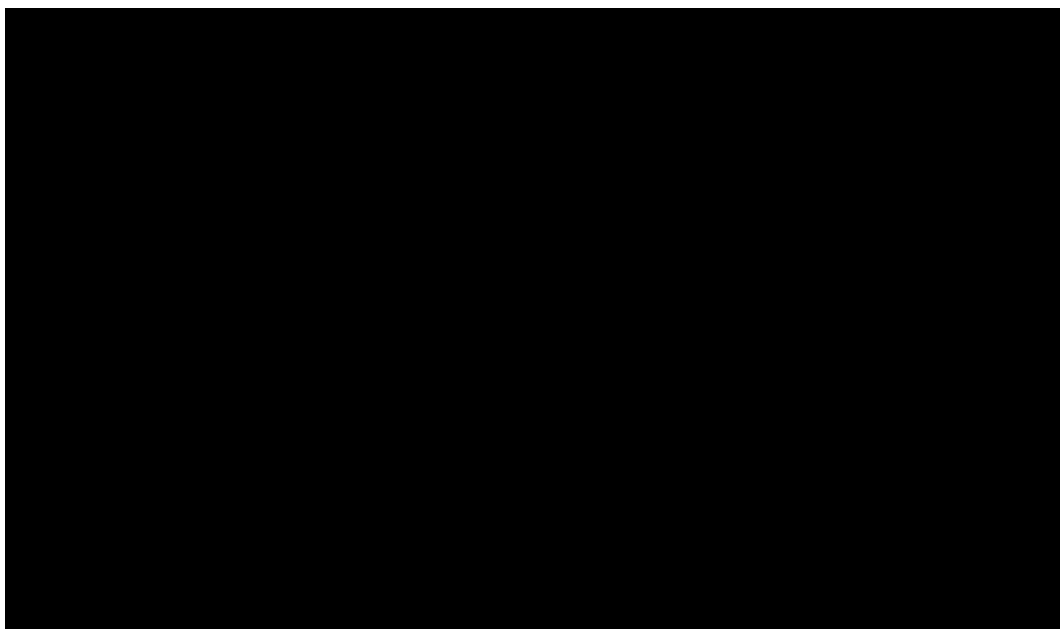
(597) The presentation then depicted [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED] [REDACTED]
[REDACTED]

[REDACTED]
[REDACTED]

Figure 65. [REDACTED]



(598) In many ways, [REDACTED]
[REDACTED]
[REDACTED] [REDACTED]
[REDACTED]



[REDACTED]

(599) Statements from internal documents [REDACTED]

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

(600) In Appendix L, I describe how:

- Publishers viewed header bidding as a way around Google’s restrictive policies regarding the use of its ad tech products, and benefited from header bidding allowing them to pit multiple demand sources in real-time competition against one another.
- Google [REDACTED] to its market power in the ad tech stack. I discuss how header bidding (in a manner similar to yield managers) could provide existing competitors or new entrants an ability to compete more effectively in the publisher ad server market by assisting publishers with accessing multiple real-time demand sources and exchanges.
- Google responded to header bidding in several ways, including launching Exchange Bidding and adjusting its bidding strategies for DV360 that had the effect of diverting advertiser spending away from third party exchanges and towards AdX. (In Section VII.D.2, I discuss another response—the restriction against setting variable price floors—that harmed the competitiveness of rival exchanges.)

(601) This discussion related to header bidding and Google’s responses supports two important points:

- First, despite the threat posed by header bidding, [REDACTED]
[REDACTED] This is in part due to Google’s extant market power across the entire ad tech stack (preserved and enhanced by Google’s conduct discussed later in this Section), which Google used in various ways to minimize the competitiveness of rival ad exchanges.

[REDACTED]
[REDACTED]
[REDACTED]

■ [REDACTED]
[REDACTED] I return to this point, and the role that competition plays in encouraging innovation, in Section VIII below.

(602) Having provided this context, I turn in the rest of this Section to discussing the conduct that is the focus of my report.

VII.B. Google provided unrestricted access to Google Ads exclusively to AdX, thereby foreclosing rival exchanges from access to Google Ads' advertiser demand

(603) Following the DoubleClick acquisition, Google launched "AdX 2.0" (hereafter, AdX) on September 17, 2009.⁸⁴⁷ A 2009 Google document titled [REDACTED]
[REDACTED] (In this Section, as I have previously, I use Google Ads to refer to the advertiser ad network component of the product formerly known as AdWords.)

(604) Since the launch of AdX, Google has restricted the demand provided by Google Ads into rival exchanges, and continues to provide unrestricted access to all of Google Ads' advertiser demand ("Google Ads demand") for display advertising only to publishers using AdX and AdSense; [REDACTED]
[REDACTED] This exclusivity provides a competitive advantage to AdX and encourages publishers to use or prioritize AdX over rival exchanges.

846 [REDACTED]
[REDACTED]
[REDACTED] See discussion in Section II.E.4 and Appendix L.3.a.

847 Neal Mohan, "The DoubleClick Ad Exchange: growing the display advertising pie for everyone," Google Official Blog, September 17, 2009, <https://googleblog.blogspot.com/2009/09/doubleclick-ad-exchange-growing-display.html>; [REDACTED]
[REDACTED]

848 [REDACTED]
849 [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

[REDACTED]

(625) As the AWBid program makes evident, Google Ads possessed the ability to bid into rival exchanges, thereby providing Google Ads' advertisers with greater access (and potentially at lower prices) to publisher inventory, and providing publishers using rival ad exchanges the benefits of competition from Google Ads' bidders.

(626) However, [REDACTED]

875 [REDACTED]

876 [REDACTED]

877 [REDACTED]

878 [REDACTED]

879 [REDACTED]

(627) [REDACTED]

(628) [REDACTED]

(629) I have examined Google Ads' purchasing behavior using data that have been produced in this matter. Since 2014, Google Ads impressions won through non-Google products (i.e., not AdX or AdSense) have not represented a meaningful proportion of Google Ads demand. [REDACTED]

[REDACTED] In 2022, [REDACTED]

[REDACTED]

880 [REDACTED]

881 [REDACTED]

882 [REDACTED]

883 [REDACTED]

884 [REDACTED]

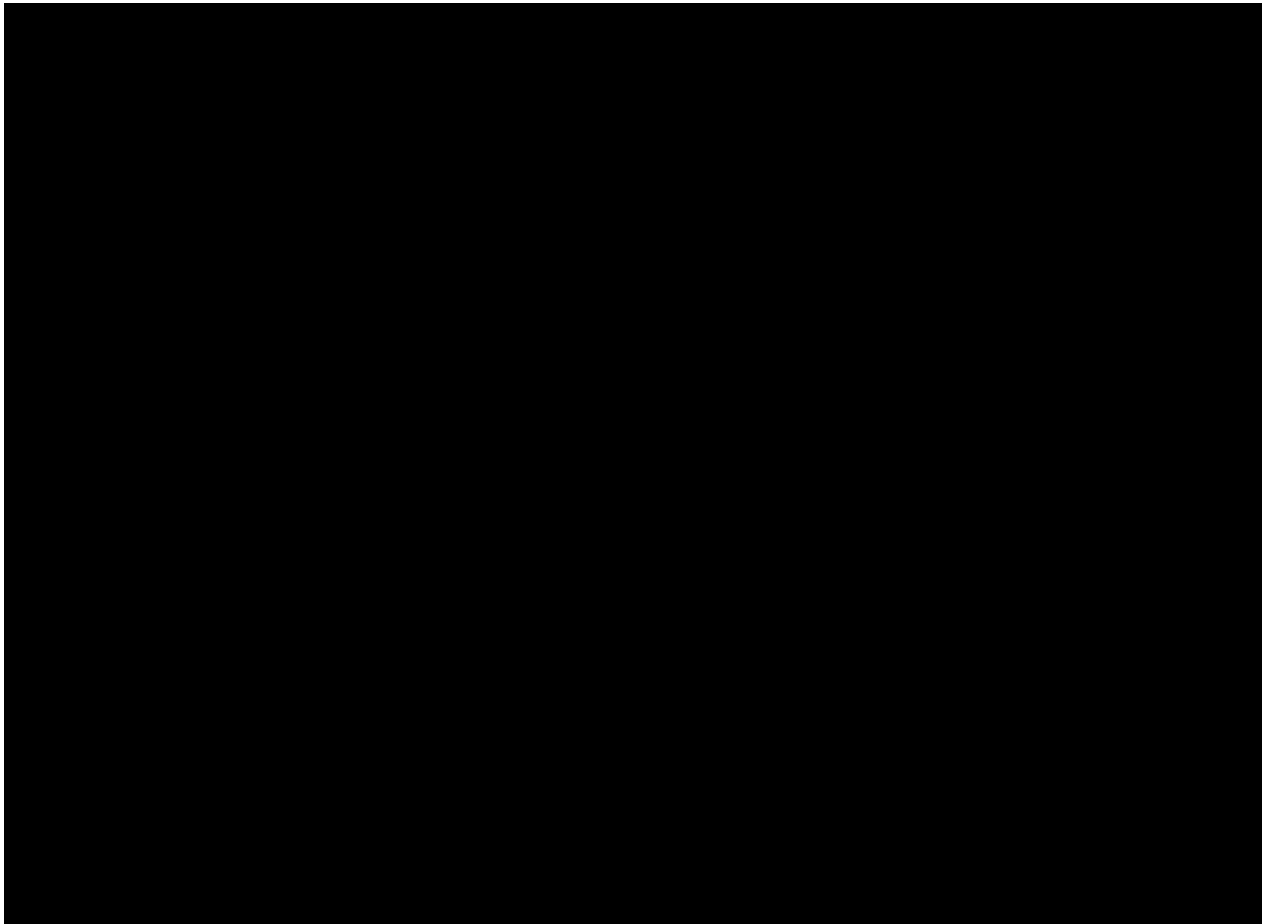
885 [REDACTED]

[REDACTED]

886 I conservatively excluded Google owned-and-operated (O&O) properties from these calculations. Including Google O&O properties would increase the denominator and therefore decrease the "non-Google inventory" percentage of Google Ads open-web display impressions. Advertisements placed through Google Ads can appear on Google Finance, Gmail, Blogger and YouTube. *See* Google, "Where your ads can appear", accessed December 17, 2023, <https://support.google.com/google-ads/answer/1704373?hl=en>.

887 [REDACTED]

Figure 66. [REDACTED]



- (630) Using Google’s log-level data from June 2023, I calculate that AdX’s share of Google Ads worldwide indirect open-web display impressions on ad exchanges is [REDACTED] and third-party exchanges’ share is [REDACTED].⁸⁸⁸ These data also allow me to examine how competitive Google Ads is when bidding across different exchanges. For this set of impressions, [REDACTED]
[REDACTED]
[REDACTED] This wide difference in “win rates” when Google Ads bids into AdX versus when it bids into a rival ad exchange is consistent with Google Ads’ bids into rival exchanges being less competitive than those it submits

⁸⁸⁸ Google Ads-AdX log-level data; Google Ads-Third Party Exchange log-level data (see Appendix H.1). I exclude AdSense from the calculation to highlight the share of Google Ads demand that goes to AdX versus non-Google rival ad exchanges; including AdSense would increase the share of Google Ads demand that goes to Google products (AdX or AdSense).

⁸⁸⁹ [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

harmed their competitiveness by exclusively providing access to AdX's real-time bids to DFP (see Section VII.F).

VII.C.3.a. AdX Direct has meaningful limitations and limited usage

(644) [REDACTED]

(645) [REDACTED]

VII.C.3.a.i. AdX Direct does not return real-time AdX bids to publishers using third-party publisher ad servers

(646) AdX does not integrate with rival ad servers in the same manner as it does with DFP. In particular, internal Google documents discuss an important reason why an AdX Direct tag does not provide publishers using rival publisher ad servers with the same features they would have on DFP: AdX

916 [REDACTED] Neal Mohan, "The DoubleClick Ad Exchange: Growing the Display Advertising Pie for Everyone," last modified September 17, 2009, <https://googleblog.blogspot.com/2009/09/doubleclick-ad-exchange-growing-display.html>; [REDACTED]

917 [REDACTED]

918 [REDACTED]

919 [REDACTED]

920 [REDACTED]

921 [REDACTED]

922 [REDACTED]

[REDACTED]

[REDACTED]

(647) [REDACTED]

(648) These descriptions are also consistent with testimony from a rival publisher ad server provider. [REDACTED]

923 [REDACTED]

924 [REDACTED]

926 [REDACTED]

927 [REDACTED]

[REDACTED]

(649)

[REDACTED]

VII.C.3.a.ii. AdX Direct's usage by third-party publisher ad servers is limited.

(650)

[REDACTED]

(651)

First, [REDACTED]

[REDACTED]

928

[REDACTED]

929

[REDACTED]

931

[REDACTED]

932

[REDACTED]

- In Section VII.D.1.c, I explain that AdX meaningfully benefitted, and rivals were meaningfully adversely impacted, from these exclusive advantages provided by DFP.

VII.D.1.a. Dynamic and Enhanced Dynamic Allocation provided AdX with “first look” and “last look” advantages over rival exchanges

(666) [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

(667) [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

(668) [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED] This reduced publisher revenues and the efficiency of the auction relative to having these demand sources compete in real time with each other.

(669) [REDACTED]
[REDACTED]
[REDACTED]

955 [REDACTED]
[REDACTED]
[REDACTED]
DoubleClick Publisher Blog, “Delivering yield, speed, and control with DoubleClick for Publishers First Look,” December 1, 2015, DoubleClick Publisher Blog, <https://doubleclick-publishers.googleblog.com/2015/12/delivering-yield-speed-and-control-with.html>

956 [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

957 [REDACTED]

958 [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

[REDACTED]

(670)

[REDACTED]

[REDACTED]

(671) By preventing other exchanges from being called upon in Dynamic Allocation, Google subjected its *rivals* to precisely the dynamic Dauwalter described. Because AdX could purchase queries before remnant line items could provide a bid, AdX could “cherry pick” higher value queries (i.e., those queries that advertisers were willing to bid more for) before its rivals. In turn, this would reduce the CPMs that rivals—whenever called—would be able to deliver, reducing their historical performance. If this occurred, as the statement indicates, publishers would likely react by “decreasing inventory access” to these rivals by ranking rival exchanges lower in the waterfall (e.g., if rankings are based on historical outcomes) or no longer calling them, leading to even lower CPMs for those rival exchanges.

(672) This “self-fulfilling prophecy” whereby “less-valuable inventory begets lower CPMs... which begets even lower CPMs” is related to an economic feature of selection markets:⁹⁶¹ [REDACTED]

[REDACTED]

⁹⁵⁹ [REDACTED]

⁹⁶⁰ [REDACTED]

⁹⁶¹ In selection markets where transactions differ in value, firms have an incentive to engage in “cherry-picking” or “cream-skimming” more valuable transactions, leaving behind the less valuable ones. See Liran Einav, Amy Finkelstein, and Neale Mahoney, “The IO of Selection Markets,” *Handbook of Industrial Organization, Volume 5*, eds. Kate Ho, Ali Hortaçsu, and Alessandro Lizzeri (2021), 390–426. With AdX’s first-look advantage, impressions that AdX did not purchase and other ad exchanges could then bid on were likely to be lower value than those impressions that AdX did purchase.

[REDACTED]

- (673) When header bidding emerged, AdX’s exclusive access to Dynamic Allocation became referred to as a “last look” advantage against header-bidding exchanges. The reason is that, previously, other remnant line items in DFP reflected historical or static prices. [REDACTED]

[REDACTED]

- (674) [REDACTED]

962 [REDACTED]

963 See Figure 151 in Appendix L.2.a [REDACTED]

964 [REDACTED]

965 [REDACTED]

(682) Note that this exercise likely understates the impact of removing the [REDACTED]
[REDACTED]
[REDACTED]¹ Such adjustments would likely lead to a much larger shift in transactions won by non-AdX exchanges.

VII.D.1.b. Google's AdX Dynamic Revenue Share program enhanced Google's Last Look advantage

(683) [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

(684) [REDACTED]⁴ As an example, if the top bid into AdX was \$1 and the publisher's floor was less than \$0.8, AdX would be able to deduct a revenue share of 20% from the \$1 bid and still provide the publisher with a bid that clears the floor. If however the publisher's floor—potentially reflective of the highest header bidding bid—was \$0.9, AdX under a fixed-revenue share of 20% would not be able to win the auction. However, under AdX DRS, AdX could adjust the revenue share in this auction—here, to 10%—and still win the auction by paying out \$0.90 to the publisher and collecting \$1 from the winning bidder.

(685) [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

981 [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

982 [REDACTED]

983 [REDACTED]
[REDACTED]

984 [REDACTED]

985 [REDACTED]

986 [REDACTED]

987 [REDACTED]

988 [REDACTED]
[REDACTED]

989 [REDACTED]
[REDACTED]

Expert Report of Robin S. Lee, PhD

[REDACTED]

(686)

[REDACTED]

(687)

[REDACTED]

(688)

[REDACTED]

990

[REDACTED]

991

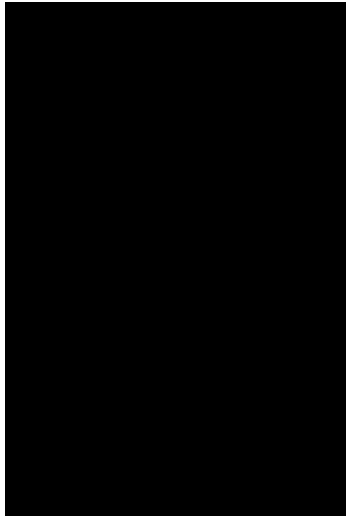
[REDACTED]

992

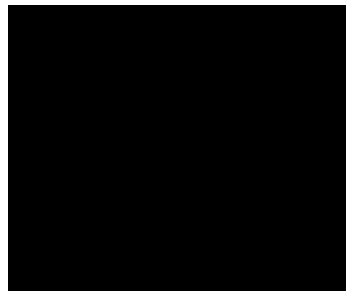
[REDACTED]

993

[REDACTED]



- (6) I also received data from the following third-party exchanges, but I do not include them in my analyses because they offer products that are either in-app or video only, and thus are not included in the product markets I've defined.



H.2. Additional limitations

- (7) Where possible, I exclude transactions that are sold through a publisher's owned and operated ad tech products from Google and third-party datasets before incorporating them into analyses.¹³⁰⁹

¹³⁰⁹



¹³⁰⁹ Publishers who sell their ad inventory through their owned and operated ad tech products include Google, Verizon (including Yahoo and AOL), Xandr (Microsoft), FAN, and Amazon. I exclude all transactions involving these publishers selling inventory through their owned and operated ad tech products from the ad exchange and bidding tools markets.

- (8) Where possible, I limit Google and third-party datasets to indirect, open-web, display transactions before incorporating them into analyses.¹³¹⁰

- [REDACTED]
[REDACTED]
[REDACTED]
- “Open-web” excludes in-app transactions.
- “Display” includes transactions with display and outstream video ad types.
- I include transactions through desktops and mobile devices. I exclude transactions through other devices, such as connected TV.

H.3. Market size calculations

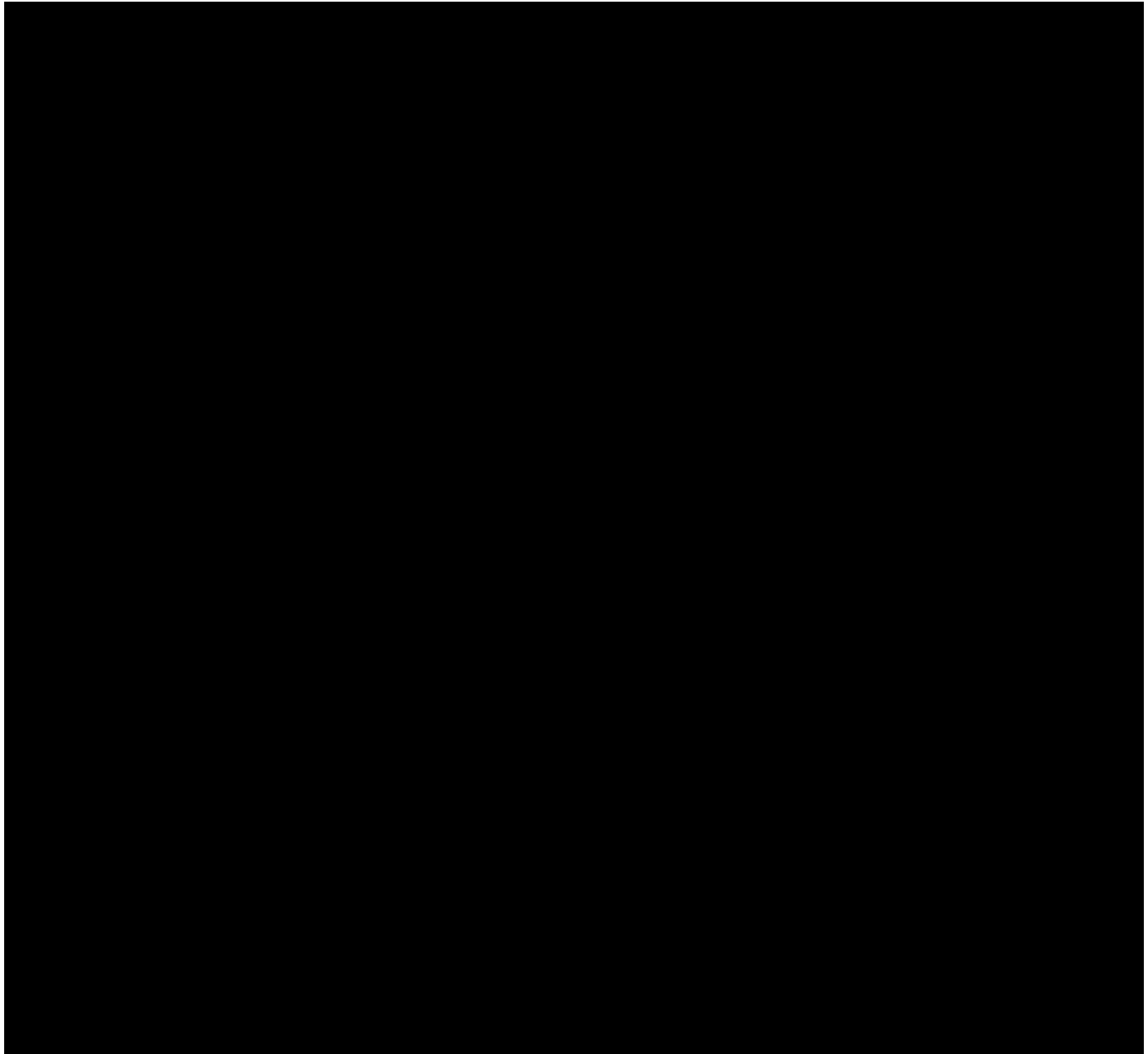
H.3.a. Setup

- (9) To explain the calculation of market sizes used for computing market shares, I define three groups of exchanges (where the identity of products in each group differ by month, depending on data availability):
1. Exchanges that produced data that identify the bidding tool source (E1)
 2. Exchanges that produced data that do not identify the bidding tool source (E2)
 3. Exchanges that did not produce data (all other exchanges, E3)
- (10) Likewise, there are three groups of bidding tools:
4. Bidding tools that produced data that identify the ad exchange (B1)
 5. Bidding tools that produced data that do not identify the ad exchange (B2)
 6. Bidding tools that did not produce data (all other bidding tools, B3)
- (11) Note that some third-party exchanges and bidding tools produced only impressions or revenue data, so these categories are defined separately for impressions and net revenue calculations. [REDACTED]
[REDACTED]

¹³¹⁰ When transaction type, channel, ad type, or device variables are missing or unknown, I assume they are in-market and include them in my analyses unless otherwise noted.

¹³¹¹ [REDACTED]
[REDACTED]

Figure 137. [REDACTED]



1312 [REDACTED]
[REDACTED]
[REDACTED]

H.3.b. Exchange market size

- (12) Using data from B1 bidding tools (those that produced data identifying transactions by exchange), I calculate the ratio of impressions or spend on exchanges that did not produce data (E3), relative to impressions or spend from exchanges that produced data (E1 and E2) in a given month (call this ratio α_m).
- (13) There are reasons that α_m values calculated using data from Google Ads and DV360 may understate the size of E3 exchanges.¹³¹³ For this reason, I exclude Google's bidding tools from the calculation of α_m .
- (14) I proceed as follows (separately for impressions and spend) for each month m :
- Define $\alpha_m = \frac{E3_m}{(E1_m + E2_m)}$ as the fraction of impressions or spending on $E3_m$ exchanges compared to impressions or spend on exchanges $E1_m$ and $E2_m$, computed for all transactions through exchanges conducted by bidding tools in group $B1_m$ excluding DV360 and Google Ads.¹³¹⁴
 - I estimate impressions or spend from exchanges that did not produce data in a given month to be:
 - $\widehat{E3}_m = \alpha_m(E1'_m + E2'_m) + [AwBid \text{ and } DV360 \text{ on } E3_m]_m$

Where $E1'_m$ and $E2'_m$ represents impressions or spending on $E1_m$ and $E2_m$ exchanges, excluding transactions to those exchanges from Google Ads and DV360.¹³¹⁵
 - The total exchange market size is then $EM_m = E1_m + E2_m + \widehat{E3}_m + AdSense_Backfill_m$ ¹³¹⁶

H.3.c. Bidding tools market size

- (15) Using data from E1 exchanges (those that produced data sufficient to identify transactions by bidding tool), I calculate the ratio of impressions or spend from bidding tools that did not produce data (B3), relative to impressions or spend from bidding tools that produced data (B1 and B2) in a given month (call this ratio β_m).

¹³¹³ The Google Ads-AdX exclusive bidding relationship implies that Google Ads has a disproportionate amount of spend and impressions on AdX (an E1 exchange) compared to third-party exchanges; moreover, there is a relatively higher share of DV360 impressions on AdX, an E1 exchange, than for other DSPs. To be conservative and not understate the size of non-Google exchanges in E3, I exclude Google Ads and DV360 when computing α_m .

¹³¹⁴ To estimate spending from E3 exchanges using data from $B1'$ bidding tools, I first remove fees taken by the bidding tools. Hence, α_m for spend is calculated as the ratio of spending (net of bidding tool fees) on E3 exchanges to spending (net of bidding tool fees) on E1 and E2 exchanges.

¹³¹⁵ [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED].

- Define $\beta_m = \frac{B3_m}{(B1_m + B2_m)}$ as the fraction of impressions or spending from bidding tools in $B3_m$ compared to impressions or spending from bidding tools in $B1_m$ and $B2_m$ from exchanges in $E1_m$, *excluding all transactions from DV360 and Google Ads*.
- Thus, I estimate impressions and spend from bidding tools that did not produce data in a given month to be:
 - $\widehat{B3}_m = \beta_m(B1'_m + B2'_m)$
 - Where $B1'_m$ and $B2'_m$ represents impressions or spending on $B1_m$ and $B2_m$ bidding tools, *excluding Google Ads and DV360*.
- The total bidding tools market size is then $BM_m = B1_m + B2_m + \widehat{B3}_m + Other_direct_m$, where:
 - $B1_m + B2_m + \widehat{B3}_m$ reflects transactions from bidding tools through exchanges.¹³¹⁷
 - $Other_direct_m$ reflects transactions from bidding tools outside exchanges (e.g., transactions that go from DSPs directly to publisher ad servers and transactions through AdSense).

H.4. Additional details

H.4.a. US market shares

- (16) In my report, I present worldwide market shares in the exchange, advertiser ad network, and publisher ad server markets. In Appendix D, I present calculations based on US customer (advertiser or publisher) location or US user location. Except for publisher ad servers, I calculate US market shares based on user location.¹³¹⁸ In datasets where only worldwide information is available from third

¹³¹⁷ [REDACTED], I am not able to identify whether transactions are going through exchanges, so I assume all transactions go through exchanges.

¹³¹⁸ I can identify user location for the following bidding tools: Adobe, Criteo, DV360, FAN, Roku, Xandr. I can identify user location for the following exchanges: AdX, AdSense Backfill, Index Exchange, OpenX, Xandr, Rubicon/Magnite, Equativ, and Yieldmo. In some datasets, it is unclear whether geography information refers to user, publisher, or advertiser location and is assigned to user location. Bidding tools where it is unclear whether geography refers to user or advertiser location include Amobee, The Trade Desk, Amazon, and MediaMath. Exchanges where it is unclear whether geography refers to user or publisher or advertiser billing location include Sharethrough, DCN, and PubMatic.

parties, I impute their US values when calculating US market shares.¹³¹⁹ In datasets where only US information is available from third parties, I impute worldwide values when calculating worldwide market shares.¹³²⁰

- (17) To estimate US transactions from exchanges and bidding tools that did not produce data, I calculate the weighted average ratio of impressions and spend attributed to US vs. worldwide users across all exchanges that produced US and non-US data. I then apply that ratio to my estimate of worldwide $\widehat{E3}_m/\widehat{B3}_m$ transactions to estimate US transactions for $\widehat{E3}_m/\widehat{B3}_m$.

H.4.b. Fee shares

- (18) To calculate fee shares, I calculate the weighted average take rate among third-party exchanges or bidding tools that produced both gross and net revenue data. I then apply that ratio to my estimate of $\widehat{E3}_m/\widehat{B3}_m$ spend to estimate total fees for $\widehat{E3}_m/\widehat{B3}_m$. I also apply this ratio to spend from third-parties that produced gross revenue but not net revenue data to estimate the total fees collected by these exchanges/bidding tools.

1319

1320

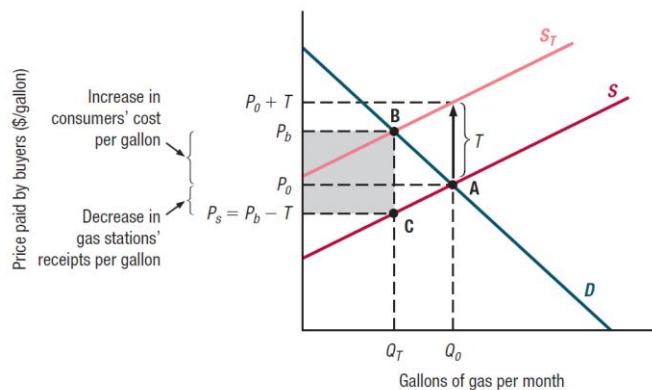
Appendix I. Economics of tax incidence

- (1) The economic principles underlying the two lessons discussed in Section III.B regarding per-transaction fees are similar to those that inform the economic effects of a tax.
- (2) First, for intuition why the total number of transactions is not typically affected by whether a given transaction fee is levied on buyers or sellers, consider Figure 141 and Figure 142 below.

Figure 141. The effects of per-unit transaction fees levied on buyers

Figure 15.1

The Effects of a Specific Tax. This figure shows the effects of a specific tax of T per gallon of gas. Without the tax, the market price would be P_0 and Q_0 gallons would be bought and sold. With the vertical axis measuring the price paid by buyers, the tax causes the supply curve to shift upward by the distance T at each quantity. With the tax, consumers pay P_b per gallon, gas stations receive $P_s = P_b - T$ per gallon, and Q_T gallons are bought and sold. The total tax collected is the gray-shaded area, which equals $T \times Q_T$. The tax causes the price per gallon paid by consumers to increase and the price per gallon received by stations to fall. The sum of the two changes equals T , the amount of the tax.

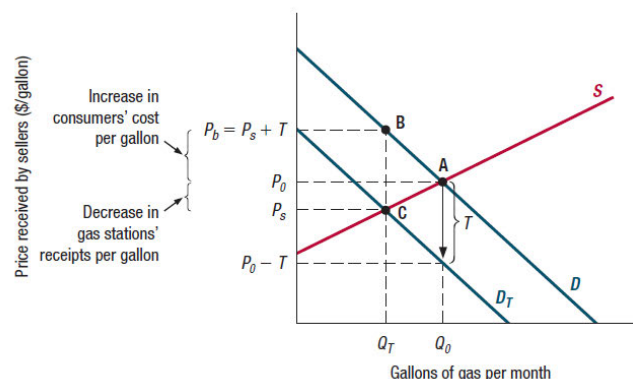


Source: B. Douglas Bernheim and Michael Whinston, *Microeconomics*, 2nd ed. (New York: McGraw-Hill Irwin, 2014), 515

Figure 142. The effects of per-unit transaction fees levied on sellers

Figure 15.3

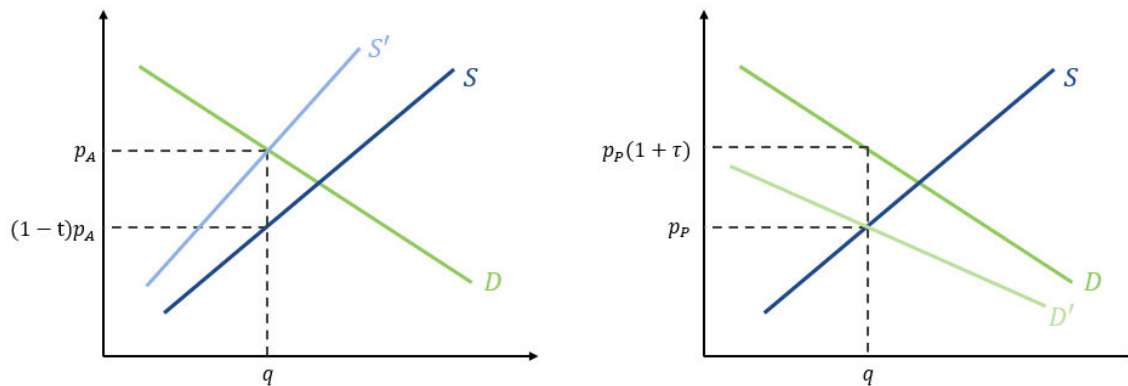
The Effects of a Specific Tax: Shifting the Demand Curve. The figure shows another way to find the effect of a specific tax. Now the vertical axis measures the price received by firms, so the tax shifts the demand curve downward by the distance T at each quantity. The outcome identified here is the same as in Figure 15.1.



Source: B. Douglas Bernheim and Michael Whinston, *Microeconomics*, 2nd ed. (New York: McGraw-Hill Irwin, 2014), 518

- (3) The Figures show a market demand (in blue) and supply (in red) curve for a good (here gasoline), in which the market price and quantity without a tax is determined by where the demand and supply curves intersect, given by P_0 and Q_0 . The market price P_0 is the price that buyers pay and sellers receive. A per-unit tax of T levied either on sellers (in Figure 142) or on buyers (in Figure 141) can be drawn as either a shift in the supply or demand curves. Note that regardless of whether the tax T is levied on sellers or on buyers, the impact on the price paid by buyers and the price received by sellers, as well as on the quantity transacted, is the same: as noted in Figure 142, “[t]he outcome identified here is the same as in [Figure 141].”
- (4) This insight, that the total number of transactions is not typically affected by whether a given transaction fee is levied on buyers or sellers, also applies to the case where fees are levied on an *ad valorem* basis, a percentage of the transaction price. Figure 143 illustrates the case where, starting from the same supply and demand curves (given by the darker blue S curve and the darker green D curve) for a good (say display impressions sold through an exchange), fees are either levied on publishers (so that for any price paid by advertisers, publishers receive that amount less a percentage fee), or on advertisers (so that for any price paid to publishers, they are charged an additional percentage fee).

Figure 143. The effects of ad valorem transaction fees levied on sellers (left) or buyers (right)



Note: The take rate t and advertiser tax τ are chosen so that $1 + \tau = 1/(1 - t)$, which makes the tax paid the same in both graphs.

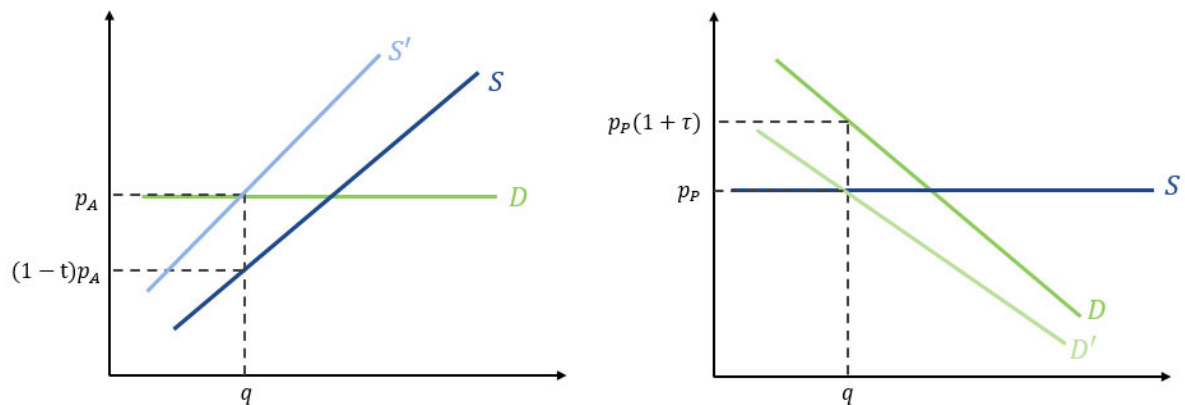
- Consider first the left panel where publishers are charged a take rate (or tax). Here, if advertisers paid a price p_A , advertisers would be willing to demand up to q units and publishers would receive this amount minus a take rate of t . If publishers then received a price of $(1 - t)p_A$, they would be willing to supply q units as well (i.e., where the price received by the publisher intersects the original supply curve S), and the market would clear at this price. Graphically, the publishers' supply curve that is a function of the advertiser price paid is represented by a supply

curve S' that is shifted inwards and steeper than the original demand curve S (which takes as an input the price the publisher receives).

- Consider next, in the right panel, the case where publishers instead receive a price p_P and advertisers pay an additional tax of τ on the transaction amount so that q units transact. Graphically, advertisers' new demand curve (as a function of the price publishers receive) is represented by a demand curve D' that is shifted inwards and flatter than the original demand curve D .

- (5) In both cases, as with the case of a per-unit tax, the prices received by publishers and advertisers and the total quantity transacted are the same.
- (6) Second, for intuition for why an ad tech product that facilitates transactions would likely possess market power as long as *either* buyers or sellers do not have perfect substitutes, consider Figure 144 which examines the ability of an ad tech product to charge a positive take rate when either demand or supply is “perfectly elastic,” but the other side is not.

Figure 144. The effects of ad valorem transaction fees when demand (left panel) or supply (right panel) are perfectly elastic



- On the left-hand side of Figure 144, demand is perfectly elastic (so that it is flat), but supply is not (so that it is upward sloping). This can occur if buyers have perfect substitutes for the product in question, so that they would not pay any price higher than some price p_A . In this case, a positive take rate would still be able to generate revenues for the ad tech product—i.e., the product would be able to charge a positive per-transaction fee without losing all of its demand—since supply is not perfectly elastic, and there are sellers who would be willing to accept a price lower than p_A and still transact. In the diagram, this is illustrated by there being some positive quantity supplied to the ad tech product even if the take rate t charged to publishers is greater than 0.
- On the right-hand side of Figure 144, supply is perfectly elastic but demand is not. This can occur if sellers have perfect substitutes for the product in question and would not accept any price lower

than p_P . Again, a positive tax now charged to advertisers—or equivalently, a positive take rate deducted from a publisher’s payout—would still result in positive quantities being transacted since there are buyers who would be willing to pay a price higher than P_P .

- (7) In Appendix I, I also noted that the economic literature on tax incidence indicates that an increase in an ad tech product’s take rate would lead to higher prices for advertisers and lower payouts for publishers (i.e., be “borne” by both advertisers and publishers) as long as neither side’s reduction is as extreme to amount to complete substitution away from the good due to a worsening in price.¹³²¹

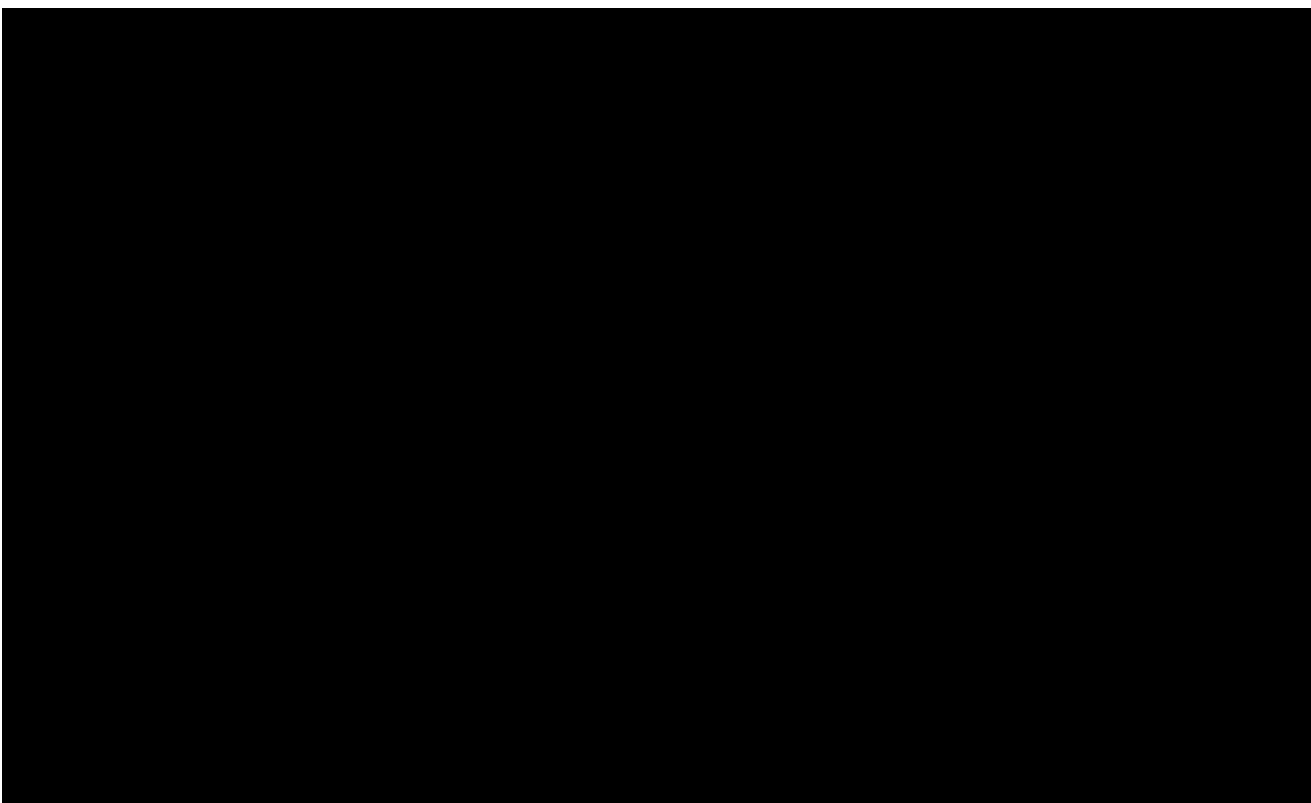
¹³²¹ Using ε_D and ε_S to denote the price elasticity of demand (from advertisers) and supply (from publishers), respectively, the standard formula for the fraction of a tax that is borne by buyers in a market is $\varepsilon_S/(\varepsilon_S - \varepsilon_D)$. According to this formula, the “less elastic” side of the market bears the greater share. See, e.g., B. Douglas Bernheim and Michael D. Whinston. *Microeconomics*, 2nd ed. New York: McGraw-Hill, 2013, 517. The intuition is as follows: the presence of a tax introduces a gap between the prices paid by buyers and the prices received by sellers. For any given price a buyer pays, a seller receives a price that is reduced by the amount of the tax. If sellers do not respond to the reduced price by reducing the supply of the product (i.e., supply is perfectly inelastic), they simply receive the reduced price and bear the entire burden of the tax. If, however, sellers respond by supplying less of the product, the quantity reduction creates scarcity in the market, whose effect is to increase the price. As a result, buyers now begin to bear a portion of the tax. The greater the sellers’ response (i.e., the more elastic their supply), the more of the tax burden will be “shifted” to buyers (as long as buyers’ demand is not perfectly elastic). See also Hal R. Varian, *Intermediate Microeconomics*, 9th ed. (New York: WW Norton, 2014), pp. 302, 304 (“As we’ve seen above, a tax [on a product sold to consumers] really shouldn’t be regarded as a tax on firms or on consumers. Rather, taxes are on transactions *between* firms and consumers. In general, a tax will both raise the price paid by consumers and lower the price received by firms. How much of a tax gets passed along will therefore depend on the characteristics of demand and supply. . . . the amount of the tax that gets passed along [to consumers] will depend on the steepness of the supply curve relative to the demand curve”) (emphasis in original).

Appendix J. Technical appendix

J.1. Fees and Margins through Google's ad tech products

- (1) Figure 145 presents [REDACTED]
[REDACTED]
[REDACTED]

Figure 145: [REDACTED]



1322 [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

J.2. AdX, Exchange Bidding, and Header Bidding

(2)

[REDACTED]

[REDACTED]

(3) The process is described as follows in the presentation as follows:

[REDACTED]

1323

[REDACTED]

Expert Report of Robin S. Lee, PhD

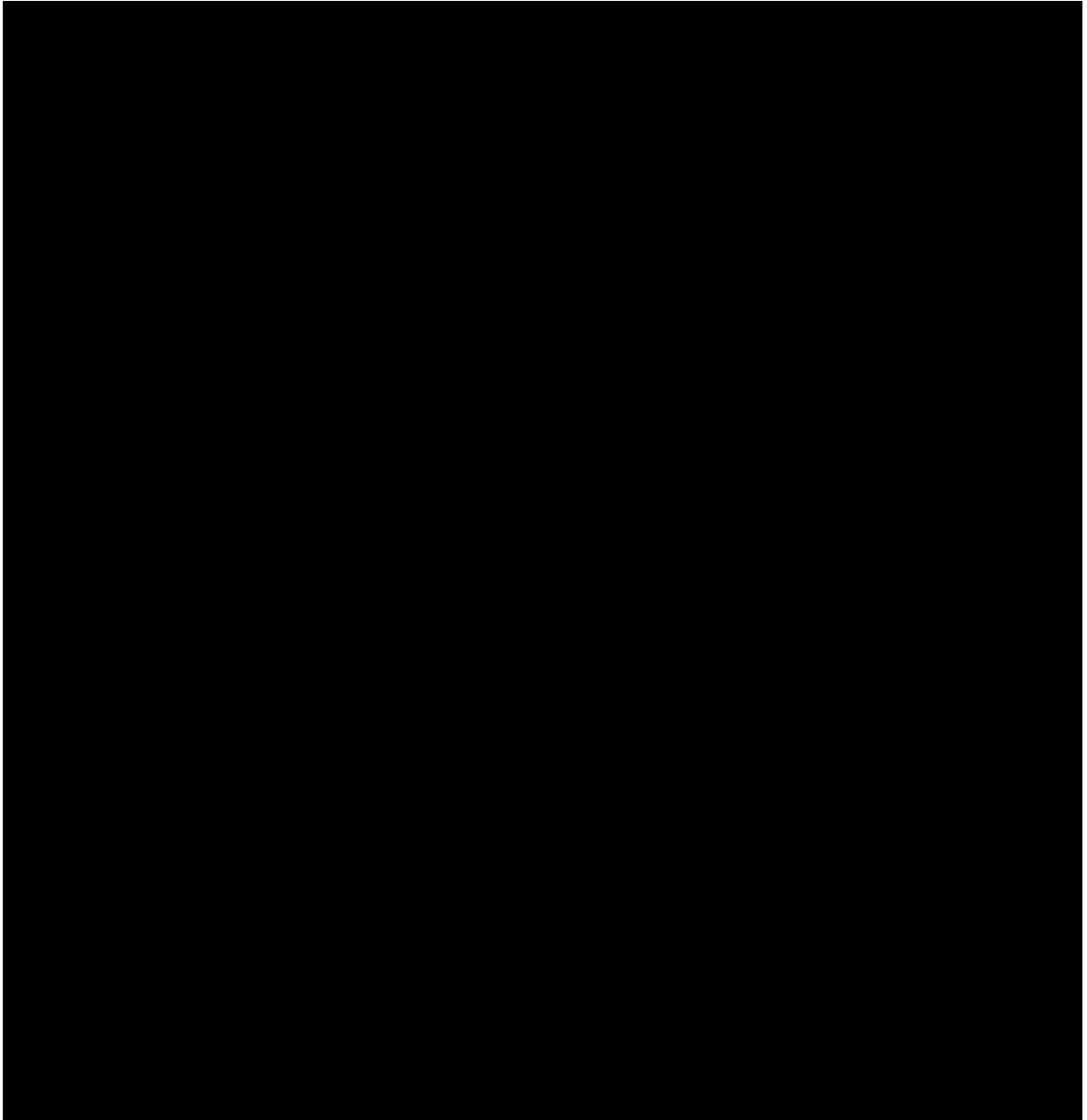


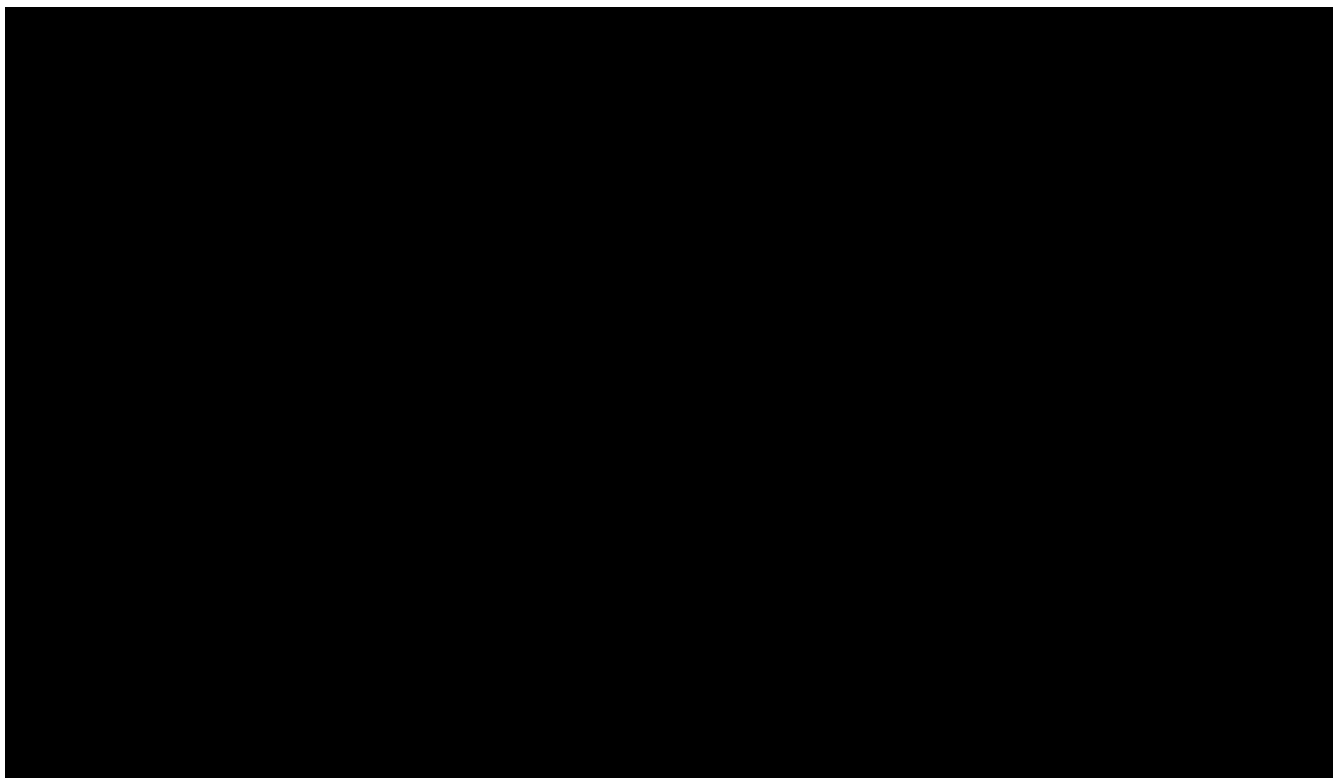
Figure 147. [REDACTED]

[illegible]

Country	Number of Publications
USA	1330
Germany	1250
France	1200
Italy	1150
Spain	1100
UK	1050
Japan	1000
Canada	950
Australia	900
India	850
China	800
South Korea	750
Others	700

[REDACTED]

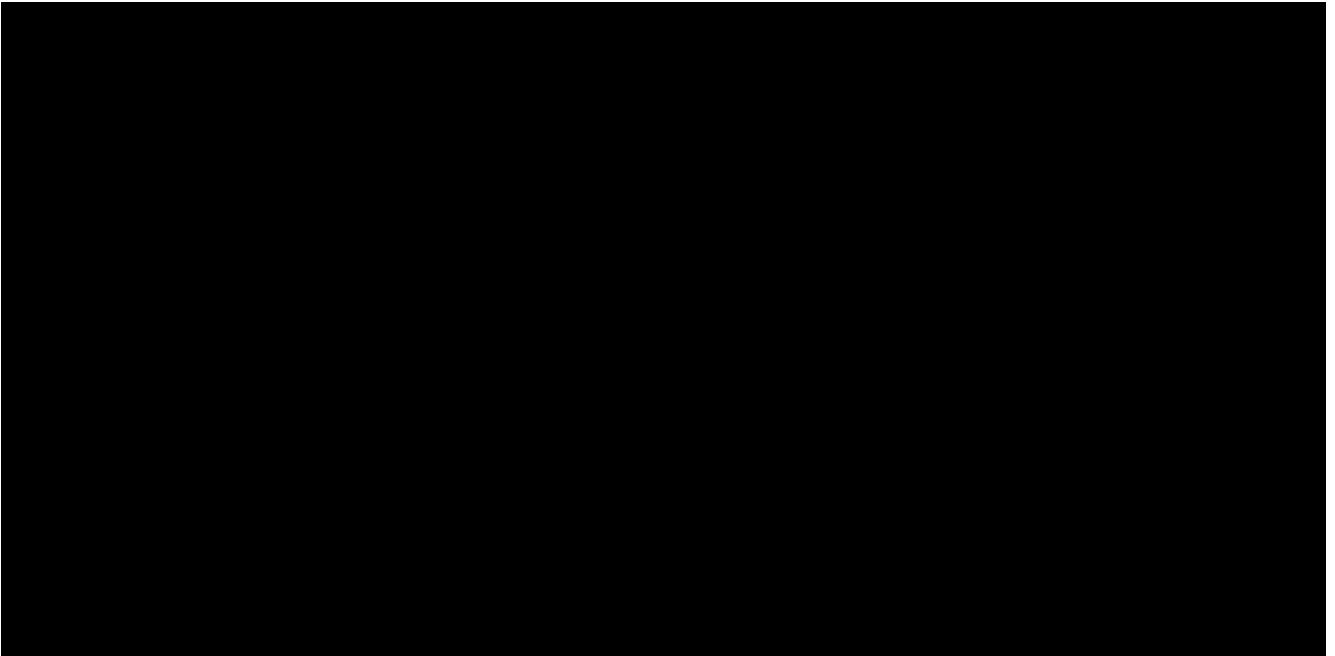
Figure 148. [REDACTED]



[REDACTED]

1336

Figure 149. [REDACTED]



K.3. Demand Product, and bidding tool features that bid into publisher ad servers

- (5) In this Section, I describe Google's Demand Product and products that allow bidding tools, including DSPs, to bid into publisher ad servers without the use of ad exchanges. These products focus on large publishers and specific use cases; as I discuss below, adoption and usage of Demand Product is low, and I have not seen evidence that adoption or usage of other similar products are more significant.

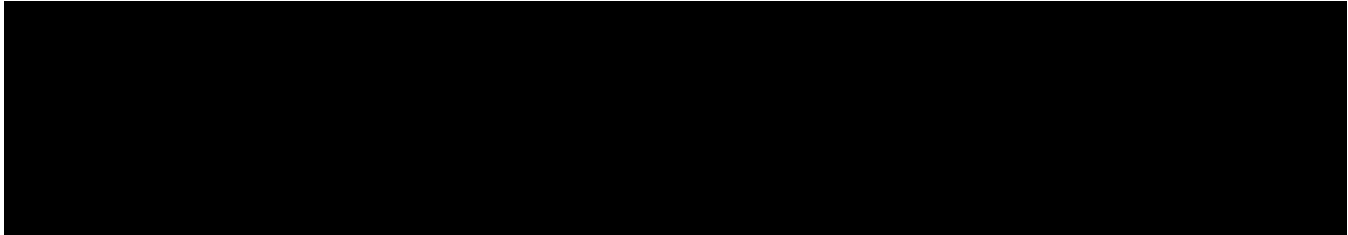
- (6) [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

1337 [REDACTED]

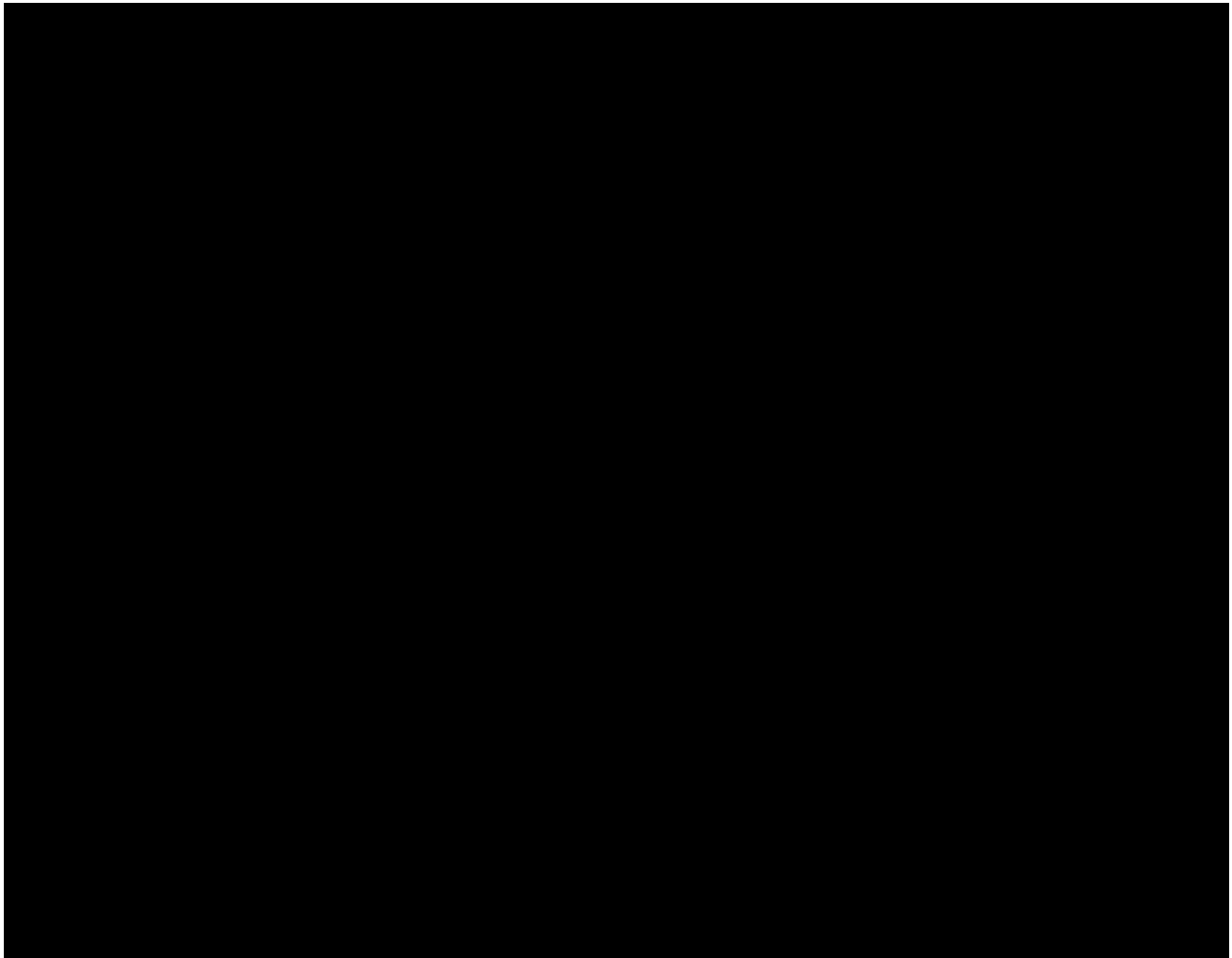
[REDACTED]

Expert Report of Robin S. Lee, PhD

HIGHLY CONFIDENTIAL



(10) **Other Products.** Recently announced product features offered by other firms include:¹³⁴⁸



¹³⁴⁸ PubMatic (“Activate”) and Magnite (“ClearLine”) are other recent products that claim to directly connect buyers and sellers. These appear to be focused on video advertisements. Ronan Shields, “PubMatic debuts Activate, as the line between demand- and sell-side players continues to blur,” Ronan Shields, “PubMatic debuts Activate, as the line



between demand- and sell-side players continues to blur,” Digiday, May 8, 2023, <https://digiday.com/media/pubmatic-debuts-activate-as-the-line-between-demand-and-sell-side-players-continues-to-blur/> (“The supply-side platform has announced the launch of Activate, an offering that lets buyers ‘execute non-bidded direct deals on PubMatic’s programmatic platform’ to access video inventory, including connected TV”); Ronan Shields, “Magnite debuts ClearLine to offer advertisers a direct route to video inventory with a DSP,” *Digiday*, Apr. 17, 2023, <https://digiday.com/media/magnite-debuts-clearline-to-offer-advertisers-a-direct-route-to-video-inventory-without-a-dsp/> (“Magnite has unveiled ClearLine, an offering that provides media buyers with access to ‘premium video inventory’ without the need for a demand-side platform”).

1349 [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

- In Q3 2023, Yahoo indicated plans to launch a product called BackStage.¹³⁵² BackStage plans to offer advertisers using the Yahoo DSP to bid on publisher inventory without an exchange.^{1353, 1354} After BackStage is launched, users of Yahoo's DSP will still be able to buy from exchanges.¹³⁵⁵

¹³⁵² Yahoo, "Yahoo Advertising to Launch Yahoo Backstage, Enabling a Direct Path to Premium Publisher Inventory," June 19, 2023, available at <https://www.yahooinc.com/press/yahoo-advertising-to-launch-yahoo-backstage-enabling-a-direct-path-to-premium-publisher-inventory> ("Yahoo Backstage will be made available to all Yahoo DSP advertisers in Q3 2023.")

¹³⁵³ Yahoo, "Yahoo Advertising to Launch Yahoo Backstage, Enabling a Direct Path to Premium Publisher Inventory," June 19, 2023, available at <https://www.yahooinc.com/press/yahoo-advertising-to-launch-yahoo-backstage-enabling-a-direct-path-to-premium-publisher-inventory> ("[Yahoo Backstage, a new offering that will provide Yahoo DSP advertisers with a direct path to curated, premium publisher inventory.](#)").

¹³⁵⁴ Catherine Perloff, "Yahoo's SPO Push, Backstage, Gives Marketers Direct Access to Publishers Without the SSP," *AdWeek*, June 19, 2023, available at <https://www.adweek.com/media/yahoos-spo-push-backstage-gives-marketers-direct-access-to-publishers-without-the-ssp/> ("After shutting its SSP, Yahoo returns to the sell side, this time representing advertiser interest"....Advertisers using Backstage, which will be available in the third quarter, will not need a supply-side platform to access publisher inventory, the traditional buying route for the programmatic supply chain.").

¹³⁵⁵ Yahoo, "Yahoo Advertising to Launch Yahoo Backstage, Enabling a Direct Path to Premium Publisher Inventory," June 19, 2023, available at <https://www.yahooinc.com/press/yahoo-advertising-to-launch-yahoo-backstage-enabling-a-direct-path-to-premium-publisher-inventory> ("Yahoo Backstage supply will be fully transparent to Yahoo DSP customers and offered alongside continued access to the industry's top Exchanges, giving advertisers the control to make their own buying choices.").

Appendix L. Background for Google's Conduct

- (11) This appendix contains useful background context to understand Google's market power and conduct analyzed in other parts of this report.
- In Appendix L.1, I discuss Google's acquisition of DoubleClick. This acquisition gave Google control of two products—DoubleClick's publisher ad server DFP and the exchange that became AdX—which facilitated its exclusionary conduct in the relevant markets.
 - In Appendix L.2, I explain how header bidding facilitated publisher multihoming across real-time bidding sources and was described by Google employees as a threat to Google's control of the ad tech stack.
 - In Appendix L.3, I summarize some of Google's responses to header bidding, including 1) launching Exchange Bidding (thereby opening up Dynamic Allocation within DFP to exchanges other than AdX); 2) adjusting its bidding strategies for DV360, including by introducing Demand Product and Project Poirot.
 - In Appendix L.4, I discuss Google's Dynamic Revenue Sharing (DRS) Programs for Google Ads, including Project Bernanke and Project Bell.

L.1. Google's acquisition of DoubleClick

- (12) As I noted in Section VII.A, Google documents indicated that controlling the publisher ad server (and the "tag" on publishers' pages) could lock-in customers and enhance its market power across the ad tech stack, and that there was concern that if a rival gained control of the publisher ad tag, Google instead might be locked out from accessing display inventory.
- (13) Here, I provide background on Google's acquisition of DoubleClick, completed in 2008. This acquisition brought DoubleClick's publisher ad server DFP and the exchange that became AdX under Google's control.

Expert Report of Robin S. Lee, PhD

Helft, "Google Buys DoubleClick for \$3.1 Billion," *New York Times*, April 14, 2007, <https://www.nytimes.com/2007/04/14/technology/14DoubleClick.html>.

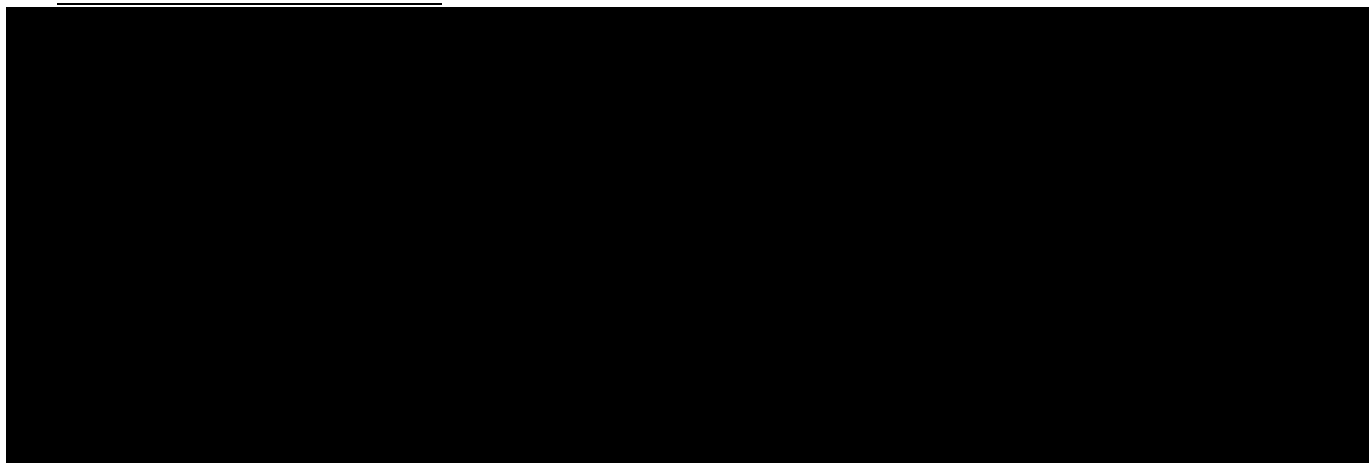
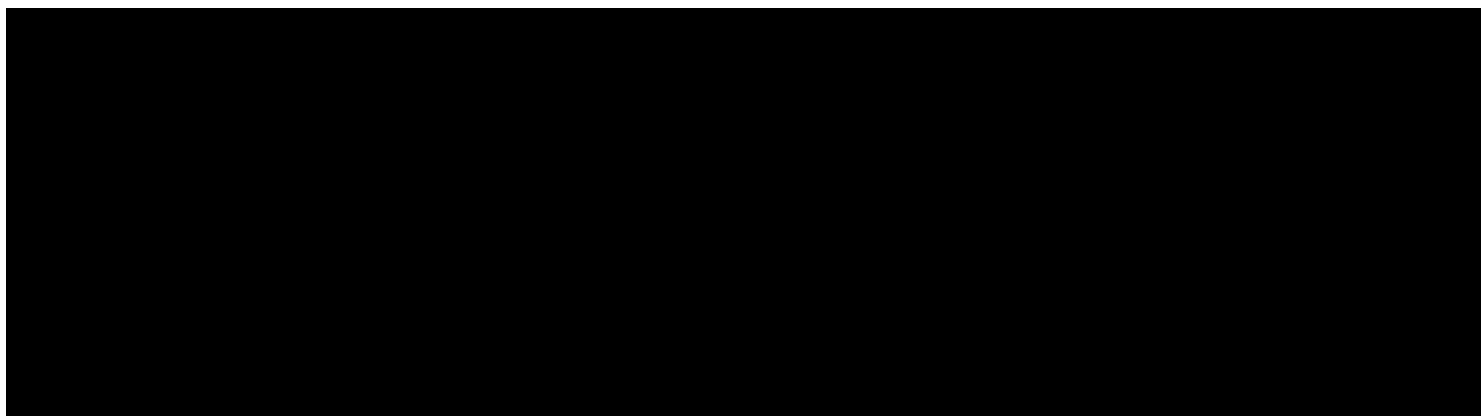
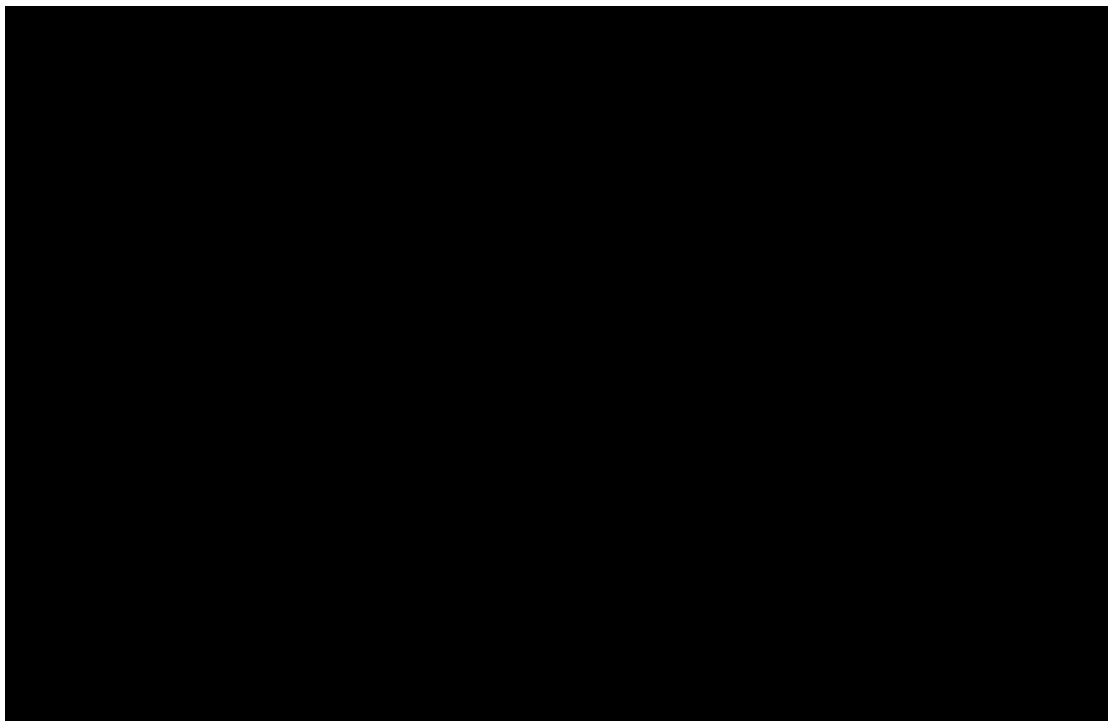
Expert Report of Robin S. Lee, PhD

[REDACTED]

[REDACTED]

[REDACTED]

Figure 150. [REDACTED]



[REDACTED]

[REDACTED]

- (22) Google’s acquisition of DoubleClick triggered an investigation by the Federal Trade Commission. The FTC investigated whether the acquisition “could harm competition by allowing Google to exploit DoubleClick’s position in the third-party ad serving markets to the benefit of Google’s ad intermediation product, AdSense.”¹³⁸² The FTC also recognized the possibility that Google might bundle its existing products with those acquired from DoubleClick.¹³⁸³ Despite these concerns, the FTC concluded that the acquisition was unlikely to substantially lessen competition in what they referred to as third party ad serving and ad intermediation markets.¹³⁸⁴ The FTC elected not to block the acquisition, but noted that “should Google engage in unlawful tying or other anticompetitive conduct, the Commission intends to act quickly.”¹³⁸⁵
- (23) Ultimately, the DoubleClick acquisition—which closed in March 2008—provided Google with a foothold in the publisher ad server market which it used to strengthen its position across the entire ad tech stack. The acquisition provided additional supply for advertisers on Google’s platforms,

[REDACTED]

¹³⁸² Federal Trade Commission, “Federal Trade Commission Closes Google/DoubleClick Investigation,” Press Releases, December 20, 2007, <https://www.ftc.gov/news-events/news/press-releases/2007/12/federal-trade-commission-closes-googledoubleclick-investigation>.

¹³⁸³ Federal Trade Commission, “Statement of the Federal Trade Commission concerning Google/DoubleClick,” FTC File No. 071-0170, at 10, December 20, 2007, <https://www.ftc.gov/news-events/news/press-releases/2007/12/federal-trade-commission-closes-googledoubleclick-investigation>.

¹³⁸⁴ Federal Trade Commission, “Federal Trade Commission Closes Google/DoubleClick Investigation,” Press Releases, December 20, 2007, <https://www.ftc.gov/news-events/news/press-releases/2007/12/federal-trade-commission-closes-googledoubleclick-investigation>.

¹³⁸⁵ Federal Trade Commission, “Federal Trade Commission Closes Google/DoubleClick Investigation,” Press Releases, December 20, 2007, <https://www.ftc.gov/news-events/news/press-releases/2007/12/federal-trade-commission-closes-googledoubleclick-investigation>.

bolstering the attractiveness of Google Ads. Similarly, DFP experienced significant growth following the acquisition. (See Sections V.D and V.B for discussion on the market power of Google Ads and DFP.)

- (24) The DoubleClick acquisition also provided the foundation for Google’s ad exchange that became AdX. In 2007, prior to its acquisition by Google, DoubleClick began developing the DoubleClick Ad Exchange.¹³⁸⁶ DoubleClick viewed the exchange as “the centerpiece of a growth plan” through which it may derive the majority of its revenue within five years.¹³⁸⁷ Following the acquisition, Google started building upon the exchange and launched AdX just two years later.¹³⁸⁸ [REDACTED]

L.2. The emergence of header bidding

- (25) In Section VII.A, I explained the important role that DFP’s market power played in supporting and sustaining its market power elsewhere in the ad tech stack. In this Section, I describe how [REDACTED]

- (26) This section is organized as follows.

- In Appendix L.2.a, I show that publishers viewed header bidding as a way around Google’s restrictive policies regarding the use of its ad tech products, and benefited from header bidding allowing them to pit multiple demand sources in real-time competition against one another.
- In Appendix L.2.b, I discuss how Google employees perceived header bidding as an “existential threat” to its control of the Ad Tech stack. I discuss how header bidding (in a manner similar to yield managers), by assisting publishers with accessing multiple real-time demand sources and

¹³⁸⁶ Greg Sterling, “Google Formally Announces New DoubleClick Ad Exchange,” *Search Engine Land*, Sept. 18, 2009, <https://searchengineland.com/googles-doubleclick-formally-announces-new-ad-exchange-26042>.

¹³⁸⁷ Louise Story, “DoubleClick to Set Up an Exchange for Buying and Selling Digital Ads,” *The New York Times*, April 4, 2007, *The New York Times*, <https://www.nytimes.com/2007/04/04/business/media/04adco.html>

¹³⁸⁸ Greg Sterling, “Google Formally Announces New DoubleClick Ad Exchange,” *Search Engine Land*, Sept. 18, 2009, <https://searchengineland.com/googles-doubleclick-formally-announces-new-ad-exchange-26042>. The original AdX product was built out of the DART platform. See GOOG-DOJ-04292352 at -352 (01/06/2011).

exchanges, could provide existing competitors or new entrants an ability to compete more effectively in the publisher ad server market.

L.2.a. Header bidding facilitated publisher multihoming across real-time bidding sources, and represented a way to circumvent AdX's advantaged position within DFP

- (27) It was widely recognized by industry observers and even Google documents that publishers were not satisfied with the waterfall system. As one industry observer noted in 2015, "At its worst, the [waterfall] model ignores pockets of high-value inventory and reduces competition, and thus artificially caps a publisher's revenue."¹³⁹¹ [REDACTED]

[REDACTED] Google promoted Dynamic Allocation as a way to increase publishers' yield by allowing real-time auctions to compete with the waterfall system, but publishers were "fed up with how Google favored its own exchange," as an industry observer noted in a 2017 article.¹³⁹³

- (28) [REDACTED] As I discussed in Section II.E.3, around 2014, publishers began to adopt a new technology called "header bidding" that allowed ad exchanges to compete against each other on the basis of their real-time demand and bids.¹³⁹⁵ To use header bidding, a publisher embeds a snippet of code in its website for each selected exchange, which enables publishers to simultaneously send requests to and receive real-time bids from multiple ad exchanges.^{1396,1397} [REDACTED]

¹³⁹¹ Sarah Sluis, *The Rise Of 'Header Bidding' And the End Of The Publisher Waterfall*, June 18, 2015, available at <https://www.adexchanger.com/publishers/the-rise-of-header-bidding-and-the-end-of-the-publisher-waterfall/>.

¹³⁹³ Ross Benes, "'An ad tech urban legend': An oral history of how header bidding became digital advertising's hottest buzzword," *Digiday*, June 16, 2017, available at <https://digiday.com/media/header-bidding-oral-history/>.

¹³⁹⁴ Ross Benes, "'An ad tech urban legend': An oral history of how header bidding became digital advertising's hottest buzzword," *Digiday*, Jun. 16, 2017, <https://digiday.com/media/header-bidding-oral-history/>. In a 2018 email from Payam Shodjai (Senior Director of Product Management, Display and Video Ads) to Brad Bender (Vice President of Product, Display and Video Ads), Payam explained that "Publishers felt locked-in by dynamic allocation in DFP, which only gave AdX ability to compete, so HB was born. HB gives many publishers better yield, so it's a no-brainer for a publisher to adopt it." [REDACTED]

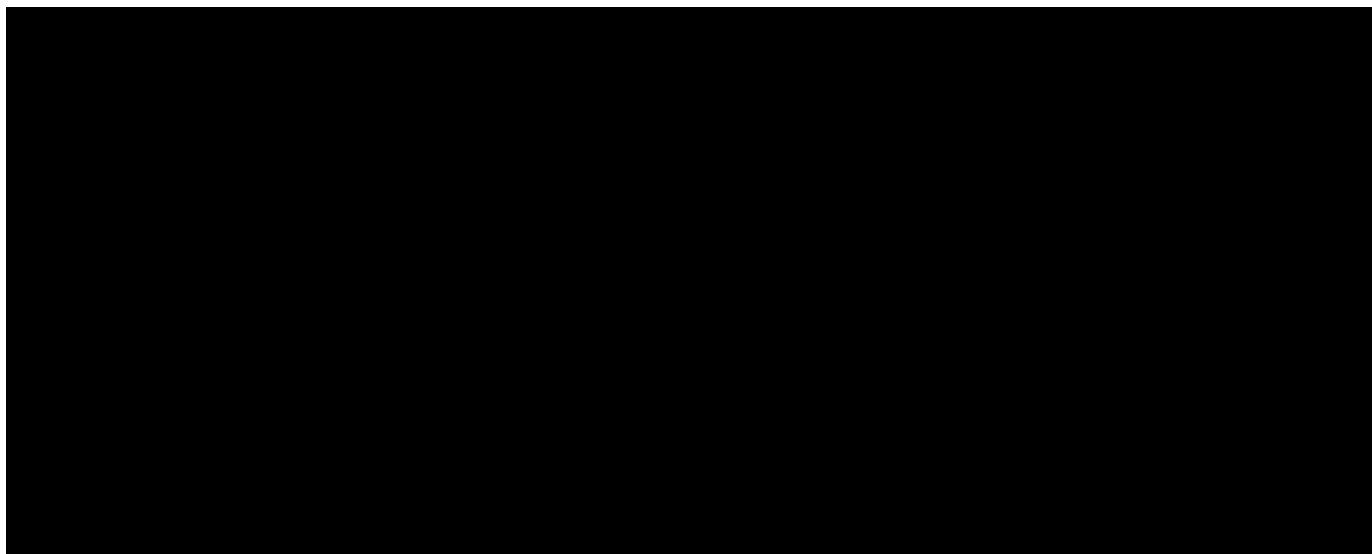
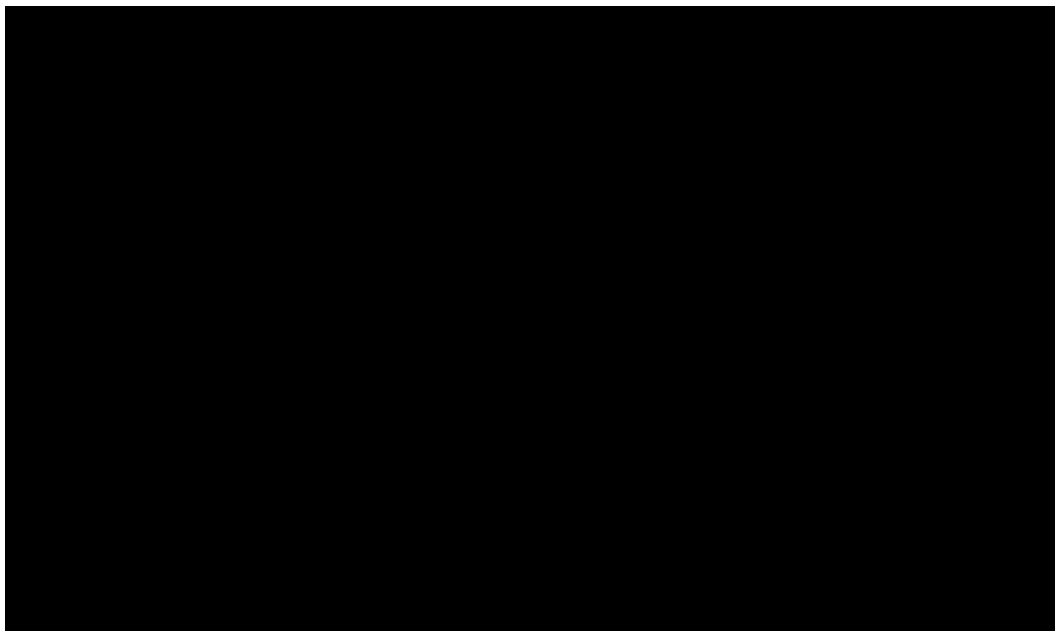
¹³⁹⁵ Rashmita Behera, *Header Bidding: A Comprehensive Guide*, Adpushup, December 9, 2019, available at <https://www.adpushup.com/blog/header-bidding-a-comprehensive-guide/>.

¹³⁹⁶ Rashmita Behera, *Header Bidding: A Comprehensive Guide*, Adpushup, December 9, 2019, available at <https://www.adpushup.com/blog/header-bidding-a-comprehensive-guide/>.

¹³⁹⁷ This form of header bidding is called client-side header bidding, because the code snippet is embedded in publishers' websites. In server-side header bidding, the auction is conducted on a dedicated auction server. Rashmita Behera, *Header Bidding: A Comprehensive Guide*, Adpushup, December 9, 2019, available at

[REDACTED]

(29) Figure 151 [REDACTED]

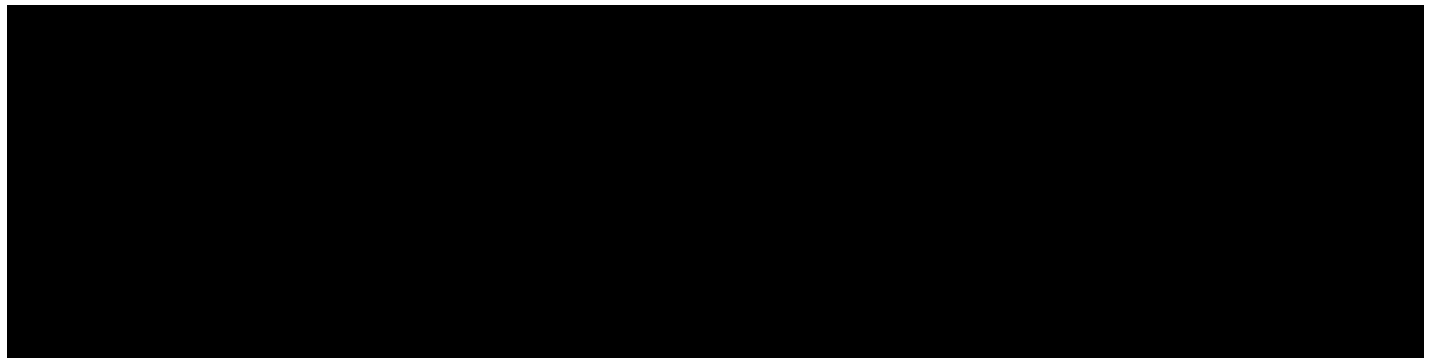
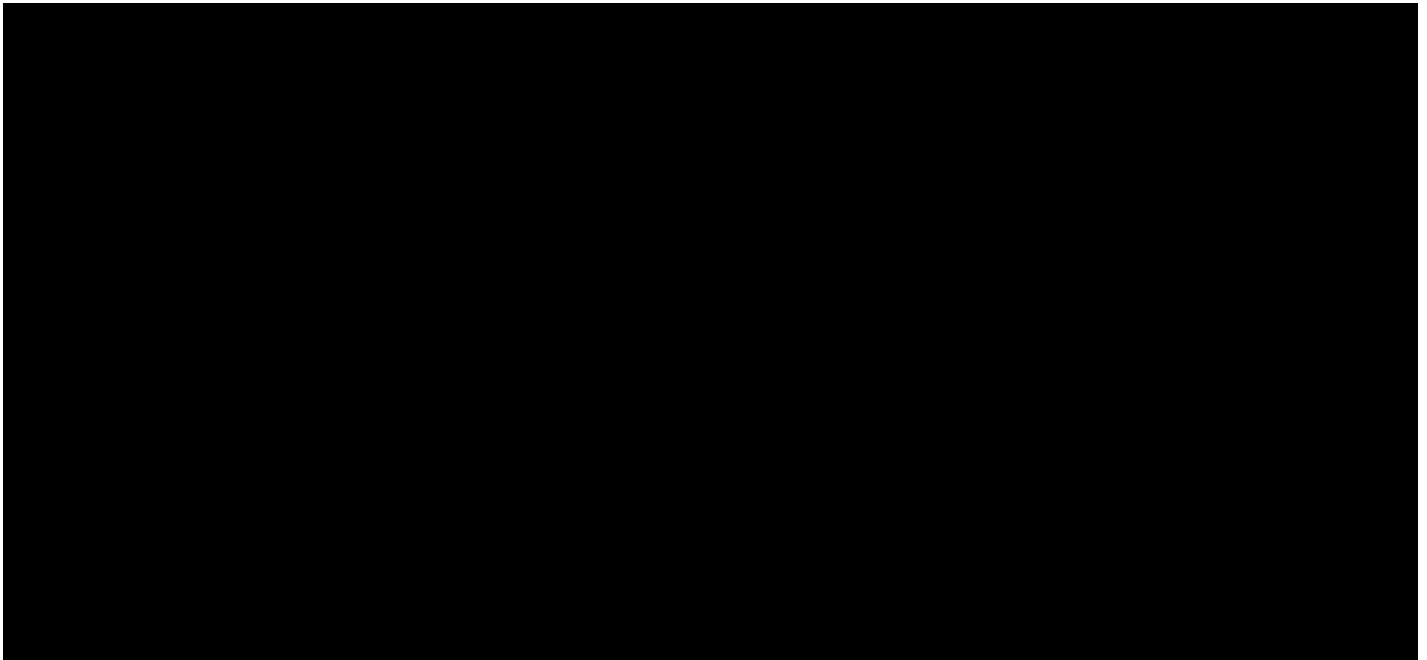


<https://www.adpushup.com/blog/header-bidding-a-comprehensive-guide/>. (“In the case of server-side header bidding, the auction is conducted on a dedicated auction server away from the user’s browser. This technique saves network bandwidth and browser resources, decreasing page latency as a result. However, when it comes to targeting, the server-side method fails to deliver the desired results due to decreased cookie match rates.”)

1398 [REDACTED]
[REDACTED]
[REDACTED]

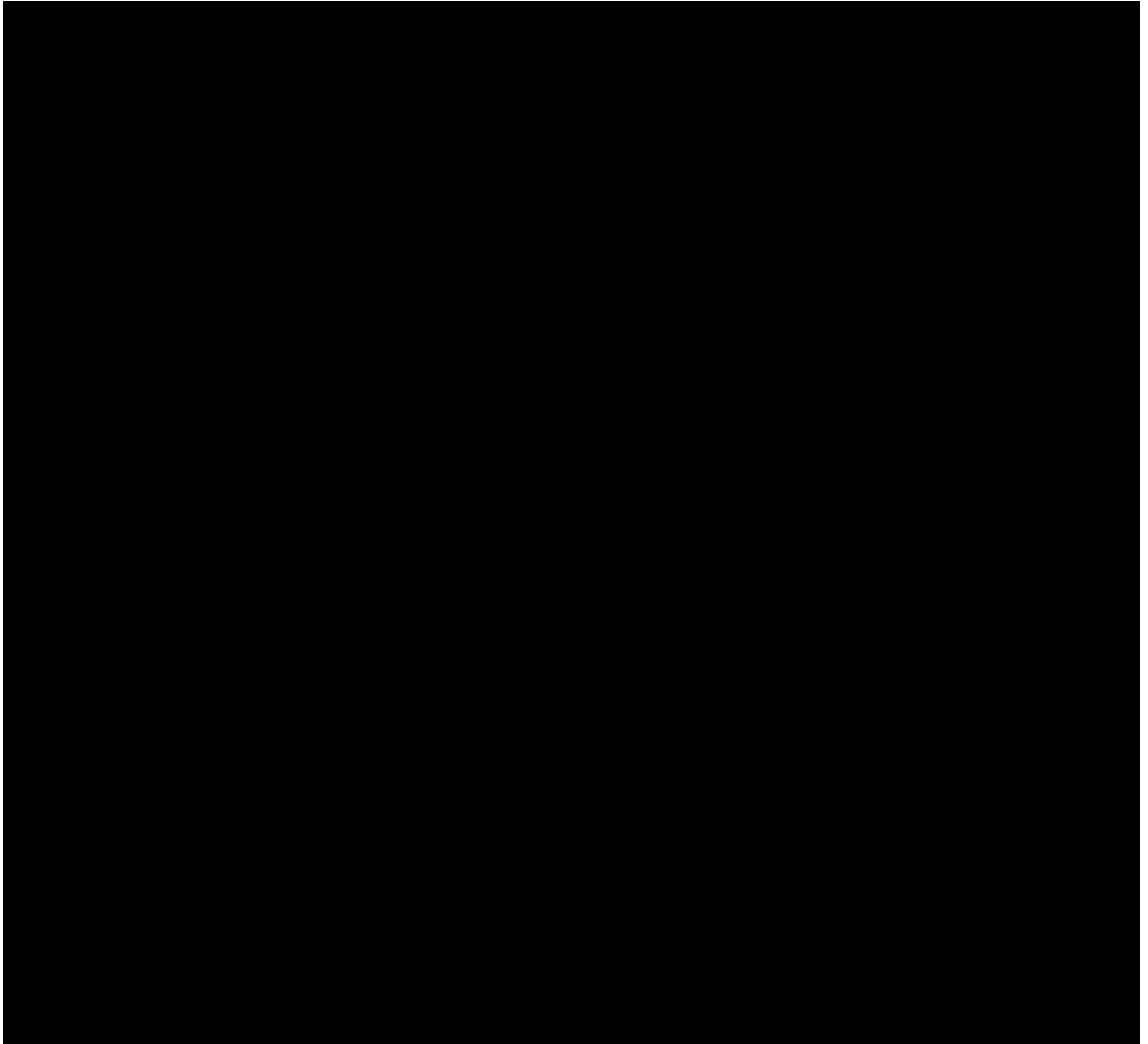


L.2.b. Google employees acknowledged header bidding as a threat



-
- [REDACTED]
 - [REDACTED]
 - [REDACTED]
 - [REDACTED]
 - [REDACTED]
 - [REDACTED]
 - [REDACTED]
 - [REDACTED]
 - [REDACTED]
 - [REDACTED]

Expert Report of Robin S. Lee, PhD



[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

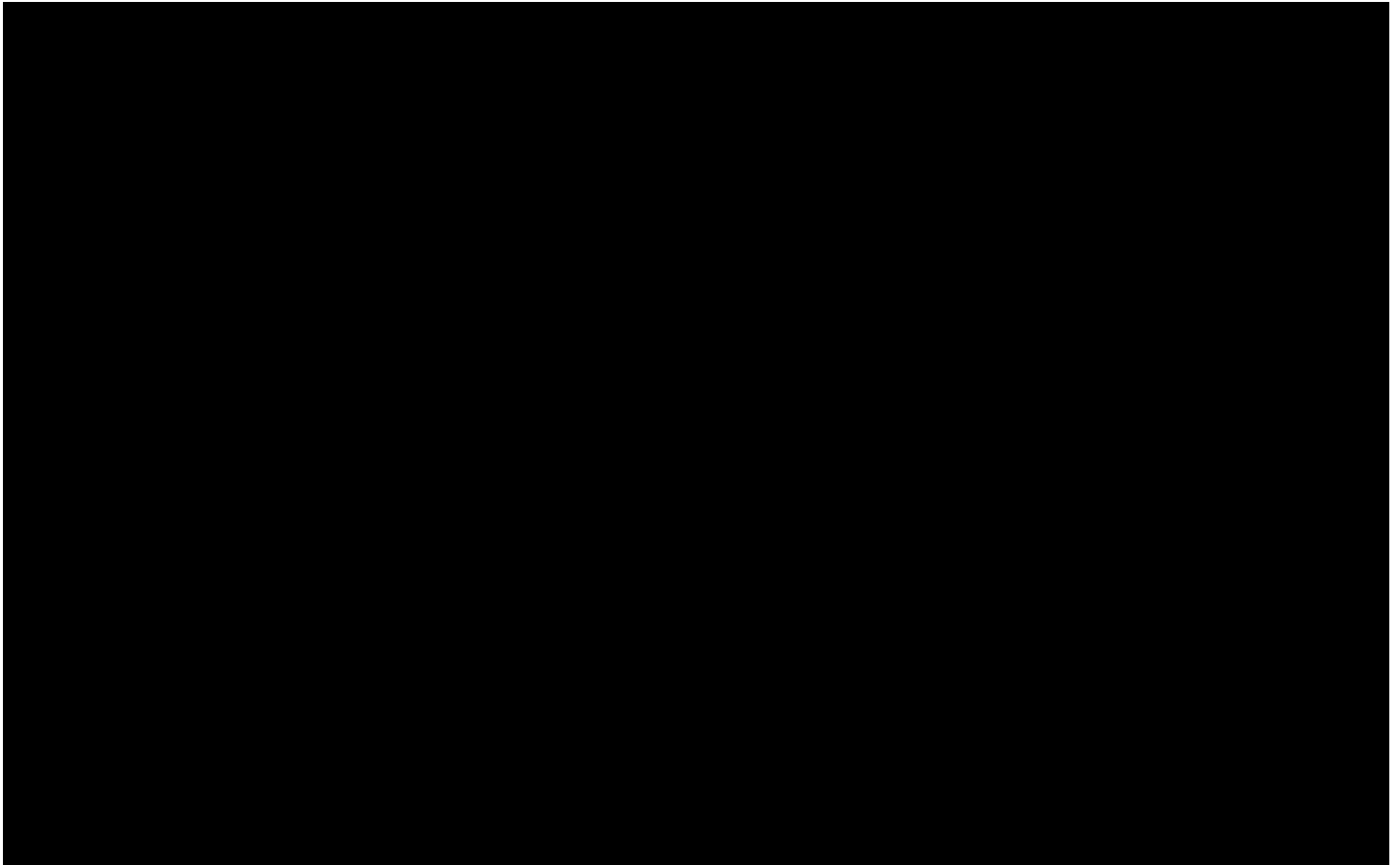
[REDACTED]

[REDACTED]

[REDACTED]

Expert Report of Robin S. Lee, PhD

Figure 152.



-
- [REDACTED]
 - [REDACTED]
 - [REDACTED]
 - [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

L.3. Google's responses to header bidding

[REDACTED]

[REDACTED]

1420

[REDACTED]

L.3.b. Adjustments to DV360's bidding strategies

[REDACTED]

[REDACTED]

1429 [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

Expert Report of Robin S. Lee, PhD

[REDACTED]

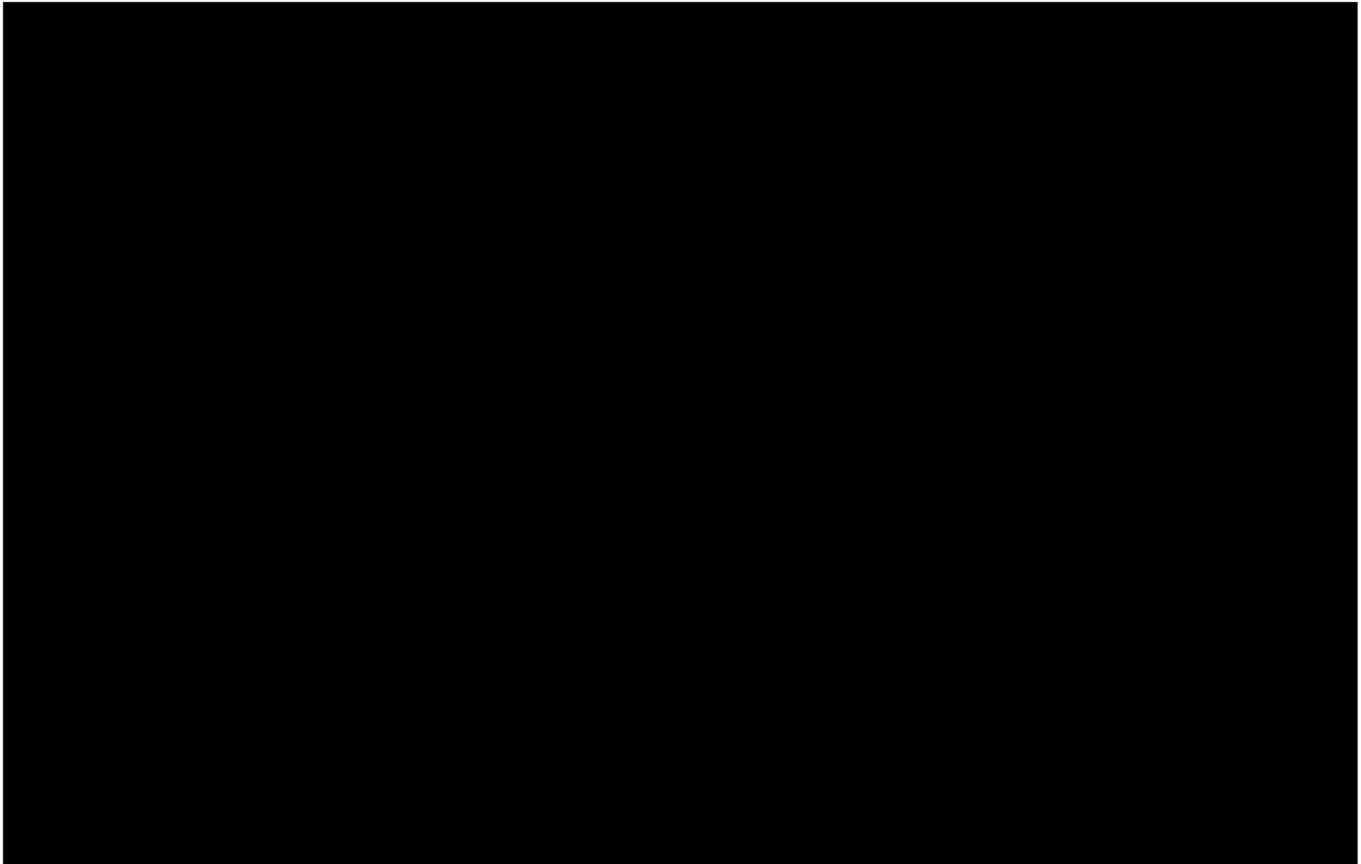
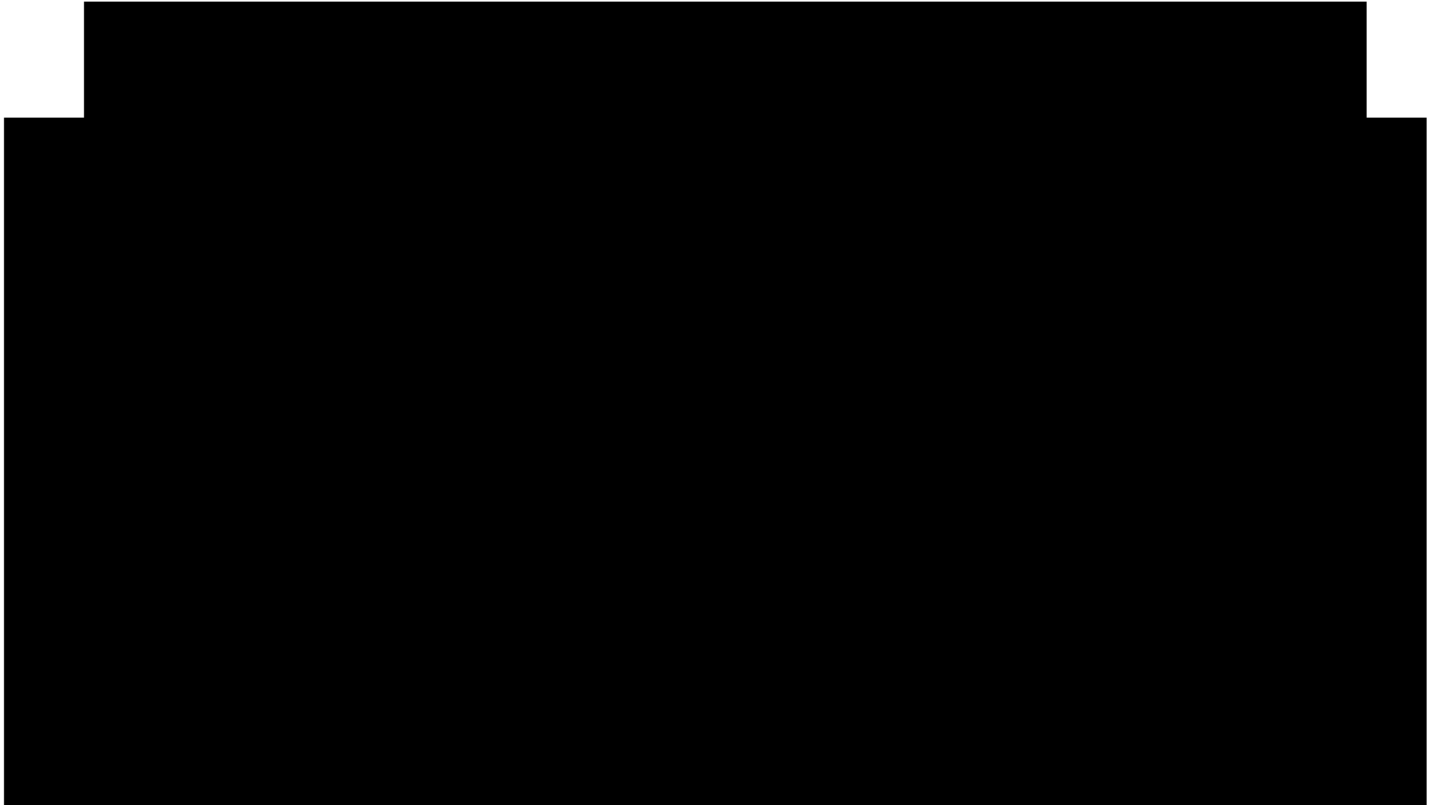
[REDACTED]

- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]

1. *Journal of the American Medical Association*, 2000; 283: 2689-2693.

Response	Percentage
U.S. should take action	71%
U.S. should not take action	28%
U.S. should take action but not at the expense of the economy	1%

Expert Report of Robin S. Lee, PhD



(70) Google Ads Dynamic Revenue Share (“Google Ads DRS”) and Project Bernanke were programs that allowed Google to dynamically adjust the margin that Google Ads targeted on impressions won through AdX in order to win more impressions and increase its profits.

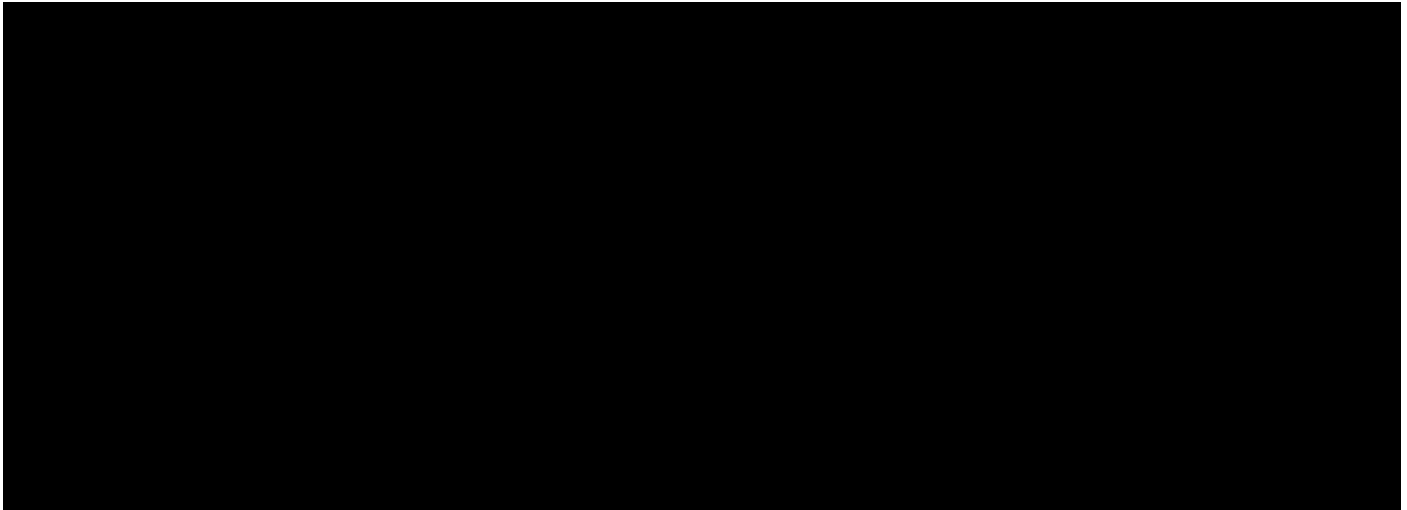
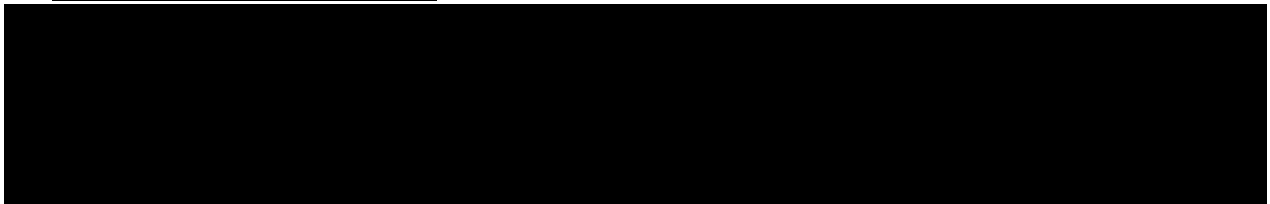
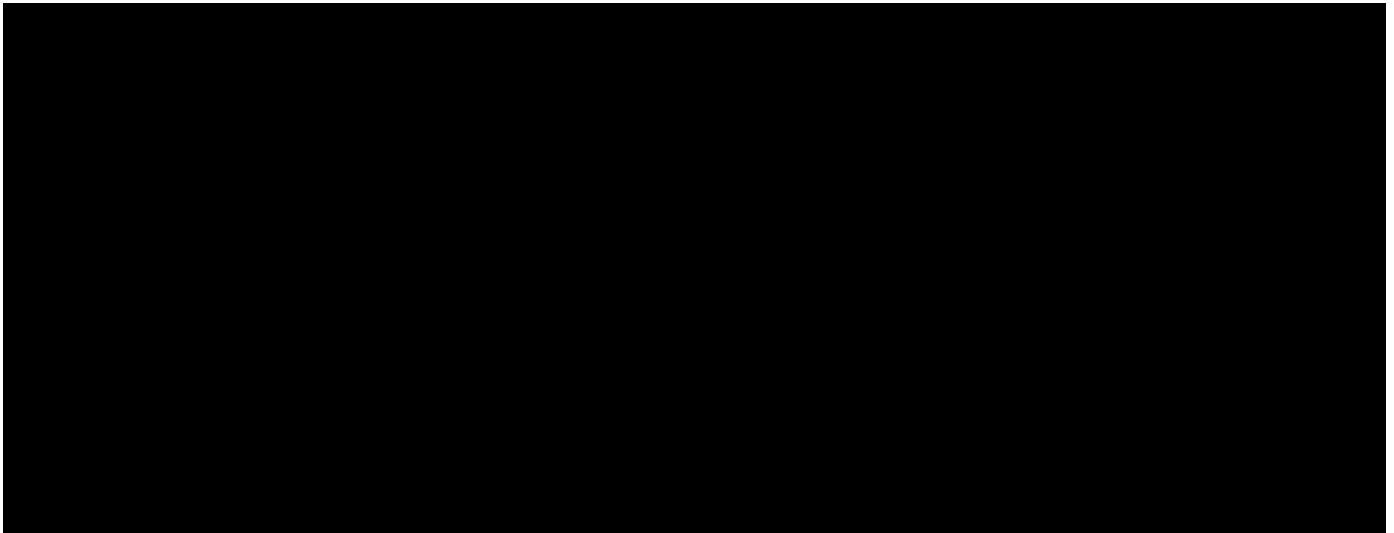
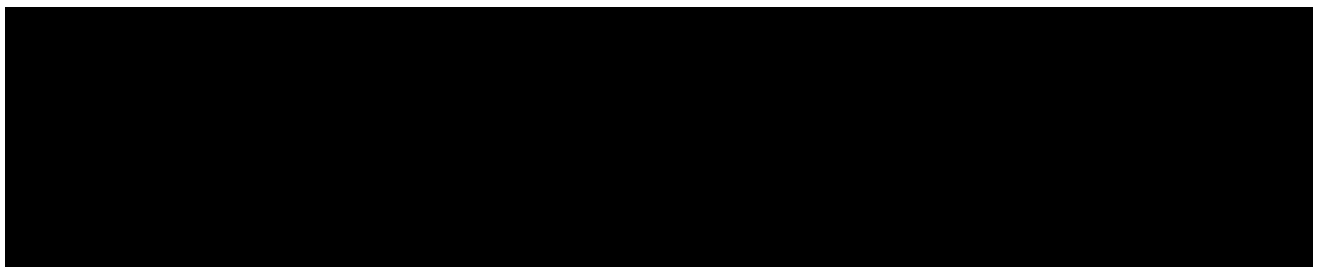
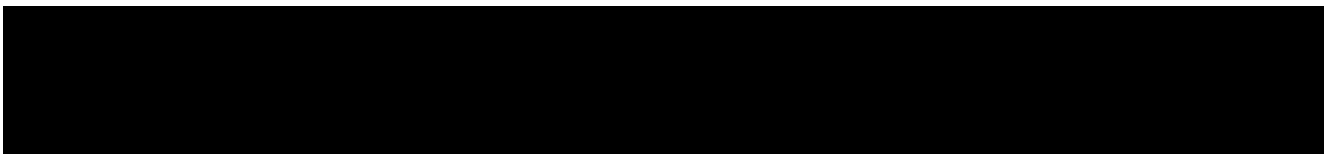


Figure 153. 





L.4.b. Global Bernanke and Project Bell



Expert Report of Robin S. Lee, PhD

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]